S. HRG. 101-805

THE NONINDIGENOUS AQUATIC NUISANCE ACT OF 1990

HEARING

BEFORE THE

SUBCOMMITTEE ON ENVIRONMENTAL PROTECTION

OF THE

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS UNITED STATES SENATE

ONE HUNDRED FIRST CONGRESS

SECOND SESSION

ON

S. 2244

A BILL TO PREVENT AND CONTROL INFESTATIONS OF THE COASTAL AND INLAND WATERS OF THE UNITED STATES BY THE ZEBRA MUSSEL, AND OTHER NONINDIGENOUS AQUATIC NUISANCE SPECIES

JUNE 19, 1990

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THE NONINDIGENOUS AQUATIC NUISANCE ACT OF 1990

TUESDAY, JUNE 19, 1990

U.S. SENATE,
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS,
SUBCOMMITTEE ON ENVIRONMENTAL PROTECTION,
Washington, DC.

The subcommittee met, pursuant to notice, at 10:36 a.m. in room 406, Dirksen Senate Office Building, Hon. Max Baucus (chairman of the subcommittee) presiding.

Present: Senators Baucus, Metzenbaum, and Chafee.

OPENING STATEMENT OF HON. MAX BAUCUS, U.S. SENATOR FROM THE STATE OF MONTANA

Senator BAUCUS. Good morning. The Subcommittee on Environmental Protection will come to order. Senator Chafee from Rhode Island, the ranking member of this committee, wished he could be here this morning for the hearing. He was called to the White House. If he can get back before the hearing is completed, he certainly will be here, but he wanted me to convey to everyone involved that he had every intention of being here, and he is very interested in the subject of this hearing.

The hearing today is called to consider legislation introduced by Senators Glenn, Kohl, Moynihan, and Metzenbaum, and other members of the Great Lakes delegation to prevent and control introductions of aquatic nuisance species.

One subject of this morning's hearing concerns the problems caused by the introduction of the Zebra Mussel to the Great Lakes and its probable spread across the continent. The species apparently was introduced from Europe into Lake St. Clair near Detroit around 1986, probably through the discharge of ballast water from ships and has now spread throughout the Great Lakes.

The infestations in Lake Erie have clogged water intakes, fouled commercial nets, and have covered beaches and boats. There is great concern that Zebra Mussels will adversely affect walleye spawning areas.

United States Fish and Wildlife Service estimates that dealing with the problems caused by Zebra Mussels in the Great Lakes will cost $5 billion over the next 10 years. The Zebra Mussel is likely to be carried by recreational boats on trailers to the Ohio River drainage in the near future, and is expected to spread throughout North American waters, including those in Montana, relatively quickly.

This morning we will hopefully hear how we can coordinate research, control, and prevention efforts directed at the Zebra Mussel. We will also be looking more broadly at the national problems created by both unintentional and planned introductions. For example, the Goldfish, Carp, and Asian Clam are just a few of the introduced species that now infest Montana waters, and there is concern that the Zander, a large aggressive member of the Perch family, recently introduced in North Dakota, will spread westward, and replace native Montana fish species.

Some of the most destructive aquatic organisms that could potentially be introduced to Montana and other States in the near future are viruses and protozoans that kill Trout, such as viral hemorrhagic septicemia and whirling disease.

This morning I hope that our witnesses will also give us their ideas about how we can develop a national program directed toward preventing further unplanned introductions of aquatic organisms and controlling any intentional introductions to prevent damage to native species and ecosystems.

With that, we will begin the hearing with testimony of Senators who are greatly concerned, who have introduced legislation, and we will begin with the Senator from Ohio, Senator Glenn.

STATEMENT OF HON. JOHN GLENN, U.S. SENATOR FROM THE STATE OF OHIO

Senator GLENN. Thank you, Mr. Chairman. I want to thank you very much for holding this hearing on the bill I have introduced S. 2244, the "Nonindigenous Aquatic Nuisance Act of 1990."

Mr. Chairman, we are facing an environmental and economic crisis here in the United States, I believe, that rivals things like the Valdez oil spill and other tragedies. You first tell somebody that you are concerned about the Zebra Mussel, they think you have been down to the health spa or something. This has been kept pretty much a secret. Nobody really knows that much about it.

I was in Toledo last Saturday and gave a commencement speech at Toledo University, and I can assure you the people in Toledo and the people around Lake Erie and the other Great Lakes are very much aware of what is going on, because this is already costing the cities and the areas there many millions of dollars per year.

The bad news is it could happen anywhere in the country. It can spread, as you have already indicated. But the good news is that we feel that we can prevent another crisis like this, and ensure that our response to the current situation is organized and effective.

Let me briefly describe our case in point. Zebra Mussels were first identified in Lake St. Clair in 1987. Since that time, they have spread throughout the Great Lakes and are expected to spread to two-thirds of our Nation's fresh water systems if left uncontrolled. In Ohio, the infestation in Lake Erie is the most intense of the Great Lakes to date.

There are water lines plugged, electric power production has been affected, our beaches are littered with shells. We have suffered from loss of water, we are worried about the lack of water pressure necessary for firefighting even in some areas. Early esti-

mates suggest that the Zebra Mussel infestation will cost the Great Lakes Region alone some $5 billion by the turn of the century.

Just so we have an idea of what we are talking about here, this is a simple little anchor rope off a boat, and this is what happens over one summer's growth of this mussel. As I understand it from the people who are experts in this field, the female lays some 40,000 eggs per year, which indicates why they proliferate so rapidly. This is just a piece off an anchor rope from one summer's growth by the Zebra Mussels.

The economic costs of the Zebra Mussel to our region are staggering. Unfortunately, the environmental costs are even greater. The Zebra Mussel will irrevocably damage the biodiversity of the lakes. They literally smother almost everything they have come in contact with, including native mussels, many of which are already on the endangered or threatened species list. In addition, they consume the planktonic life at the lower end of the food chain, leaving too little for the native fish and wildlife of the lakes. They will do the same thing as they spread through the other river and lake systems of the country.

Zebra Mussel infestation has reached crisis proportions within the Great Lakes Region. The fact is, however, that the Zebra Mussel is not the only aquatic nuisance with the potential to destroy local economies and natural ecologies.

For example, we have such things as the River Ruff, the Spiny Water Flea, and the Tubenose Goby. These are actual names, these are not jokes. The River Ruff, Spiny Water Flea, and the Tubenose Goby also have been identified——

Senator BAUCUS. Tubenose Goby?

Senator GLENN. Tubenose Goby, and I would not sit before you this morning here, Mr. Chairman, and indicate I am an expert on the Tubenose Goby, but I have been informed that that also is one of our nonindigenous species that infests the Great Lakes Region.

Senator BAUCUS. How did the Tubenose Goby get there?

Senator GLENN. We think by the same way that the Zebra Mussels got there, and that is through ballast water on ships coming in from other parts of the world. I believe you have a couple of experts here this morning who can testify on the origins of some of these things—what I am pointing out is that the Zebra Mussels are not the only thing being brought in that have been identified as being a real danger not just for the Great Lakes, but for the fresh water systems of our whole country as they gradually spread.

In our salt water coastal areas, too, the Asiatic Clam, Japanese Seawood, and the Red Tide damage our native shellfish and marine industries.

The U.S. has tight policies to protect itself from invasions by agricultural pests, but we have nothing to protect ourselves against the environmental and economic damages of nonindigenous, aquatic species. Right now, new exotic species are entering our fresh and salt water systems the same way the Zebra Mussel did. Each infestation could cost our country millions of dollars in precious environmental assets.

The time for reducing the risk of such infestations and establishing a system for abating damage already in the making is right now.

What is the best approach to achieving prevention and effective response? I asked the people of Ohio, Great Lakes regional organizations, Federal agencies and national and international experts, and, over and over, I was told that the two greatest needs are:

One, regulation of ballast water to immediately reduce the risk of new introductions of organisms like the Zebra Mussel; and

Two, coordination of research, control, educational and monitoring efforts throughout affected regions.

My bill, the Nonindigenous Aquatic Nuisance Act of 1990, which was co-sponsored by several members of this committee, provides a framework to accomplish these objectives.

Title I is the prevention title. It is directed at a significant and controllable vector of introductions, the ballast water of ships. The bill orders the Coast Guard to develop and enforce environmentally sound ballast water practices, starting with high seas ballast water exchange where appropriate. The bill considers issues of ship safety and treated ballast. It is also flexibly written so that alternative techniques can be substituted in the future.

Today it is illegal to bring food from a foreign country into the U.S. without an inspection. However, ships can drop as much as six million gallons of foreign ballast into any U.S. harbor unrestrictedly.

I hope that the committee will agree that the situation is serious, relatively easy to remedy, and should be addressed, even with temporary measures as soon as possible.

Judging from our experience with the Zebra Mussel, coordination among jurisdictions, sectors, and levels of government is also key. Title II of S. 2244 would establish a coordination mechanism for research, education, and control of nonindigenous aquatic nuisance species. Research roles are defined for the U.S. Fish and Wildlife Service and for NOAA, National Oceanic and Atmospheric Administration. There is a provision for a memorandum of agreement between these agencies in order to maximize the use of existing capabilities. However, if no such agreement is reached, the bill describes lead agency roles. A role for the Environmental Protection Agency would further strengthen this formula.

Aquatic nuisance species do not respect State or national boundaries, but are often regional in impact. The title also provides for the establishment of regional commissions composed of a broad spectrum of interest groups to coordinate the responses of individual regions to aquatic nuisance infestations. The bill requires that one such commission be established for the Great Lakes.

Clearly, too much bureaucracy is a legitimate concern. In the case of the Great Lakes a standing commission, such as the Great Lakes Commission or the Great Lakes Fishery Commission, should be evaluated for their potential in providing this coordination in response to the Zebra Mussel production.

Finally, the bill encourages international cooperation and would declare the Zebra Mussel an injurious species to prevent intentional transport of this most harmful organism.

Mr. Chairman, again, I thank you very much for holding this hearing on S. 2244, the Nonindigenous Aquatic Nuisance Act of 1990. I am very happy to work with you and the other members of this committee, to develop a final vehicle which meets the needs of

all those concerned, and so please feel free to call on me or my staff for any assistance we may be able to offer.

Senator BAUCUS. Thank you very much, Senator, for that very interesting and persuasive statement.

Senator Kohl of Wisconsin.

STATEMENT OF HON. HERB KOHL, U.S. SENATOR FROM THE STATE OF WISCONSIN

Senator KOHL. Thank you, Mr. Chairman. I, too, along with Senator Glenn, am very pleased to be here this morning to talk briefly about the problem which seriously threatens the Great Lakes Region and beyond, and that is the problem of the Zebra Mussel. I very much appreciate the opportunity to testify before your committee about legislation, which Senator Glenn and I and a number of our colleagues have introduced, the Nonindigenous Aquatic Nuisance Act of 1990.

The Zebra Mussel, as you are all aware, is a tiny, marble-sized clam, capable of causing billions of dollars worth of damage to industry, utilities, and fishery resources throughout the Great Lakes Region and across the entire country. In my own State of Wisconsin numerous industries will be affected, including shipping, paper production, commercial and recreational fishing, and tourism, among others.

Most immediately, I am concerned about drinking water supplies which could be disrupted by the Zebra Mussel. Approximately 25 million Americans get their drinking water from the Great Lakes. We have already seen what can happen when Zebra Mussels set up housekeeping in a city's water intake pipes. The city of Monroe, Michigan, for example, had to ration water for several days when Zebra Mussels clogged that city's water intake pipes. They spent $500,000 on emergency repairs to remove the mussels, which had reduced water intake flows by 25 percent. Many other cities are likely to have similar problems if we do not act quickly.

In addition, I am very concerned about the many power plants located along the Great Lake shoreline, and we have several in Wisconsin. These facilities depend on a steady supply of water from the Great Lakes. To prevent shutdowns, very costly modifications will have to be made to hundreds of intake pipes and valves. It is more than a matter of keeping the generators running so that we can turn on lights and run our factories. Public safety is a very important factor in this debate. We can easily imagine the dangers posed by a water supply disruption at a nuclear power plant, of which there are several along the Great Lakes shoreline.

The Zebra Mussel has already reached Wisconsin. They have been located in the Duluth-Superior Harbor, in Lake Superior, on a vessel in the Milwaukee Harbor, and on a barge in Sturgeon Bay, so it is just a matter of time before their colonies are firmly established. This is no longer just a problem for our eastern neighbors along Lakes Erie and Ontario.

Equally important is the fact that this is not just a shoreline problem. This creature can survive for 14 days out of water, allowing it to spread through buckets and boat hauls being transported

by land. Every river and lake in the United States could eventually be infested with the Zebra Mussel.

Wisconsin's Fox River, which feeds into Green Bay, is likely to be an early target. Already the numerous paper companies in the Fox River Valley are bracing for the attack. Their operations will be severely hampered or even curtailed if water intake pipes along the river are clogged by Zebra Mussels. After leaving its mark on the Fox River, Lake Winnebago and western Lake Superior, it is just a matter of time until the Zebra Mussel reaches the Mississippi River and beyond. Every one of our States could therefore face this disaster in the making unless we act quickly and effectively.

Mr. Chairman, I am here today because the people of Wisconsin and across the country want the Federal Government to step in before the problem has reached the point of no return. The Zebra Mussel poses a dangerous and costly threat to our country, and I do not believe the menace will be conquered without Federal support.

Furthermore, I have no doubt whatsoever that the costs of inaction will be much higher than the costs of research, public education, and prevention, which our legislation would require.

S. 2244, which costs about $40 million over five years, will help save the Great Lakes Region and estimated $5 billion in damage and repair costs over the next decade. Moreover, this legislation may help prevent the Zebra Mussel from reaching our western States, Mr. Chairman, and it may help prevent other exotic species entering United States' waters.

In sum, I would respectfully urge this committee to carefully consider the legislation that Senator Glenn and I have introduced. I will be happy to work with the committee in any way to help achieve passage of this important measure.

I thank you, Mr. Chairman.

Senator BAUCUS. Thank you very much, Senators.

I am just curious where this little beast comes from, what part of the world, and whether there are any natural enemies from wherever this Zebra Mussel came from.

Senator GLENN. I believe, while I am not a marine biologist, certainly, I understand that the feelings are it came from some of the fresh water rivers in Europe, and some of the other species I mentioned here, of course, come from different parts of the world, but this particular one comes from some of the fresh water areas in Europe. When ships go in and take ballast water out of those rivers, these organisms are sucked up into the tanks, they are transported, and this water is dumped in our harbors here. That is considered to be the major source of infestation.

I think the feelings are that back in the old days, when these ships did not go across the Atlantic quite as fast that the lack of oxygen and the additional time that is required for transit of the Atlantic back in those days made it more likely that they would be killed before they got over here, and the actual oxygen loss in that ballast water over a period of time would actually kill them.

Another factor that I have been told that has permitted more rapid spread of these is the fact that we have had cleaner water in some of our harbors, and they thrive better in the cleaner water environment than they did in the polluted water environment.

I think you have some experts that are going to testify here a little bit later today, and they can probably tell you a lot more about the life cycle of these than I can.

Senator BAUCUS. We will certainly ask them. I am curious, though, while you are here, do you by chance know, are there natural enemies in the Black Sea and the Caspian Sea, where apparently these come from?

Senator KOHL. I am not aware. I understand that in Europe what they have done is aligned the water pipes at great cost, so it is not as though they are not infested and are not involved with the cost of the Zebra Mussel.

What we are trying to do here is to prevent that cost from afflicting us also, but they have not, to the best of my knowledge, devised any natural enemies to eradicate them.

Senator BAUCUS. This is very similar to a problem we face in my State of Montana. We have a Spotted Nap Weed and Leaky Spurg which are taking over our State. These are plant species that came from Europe, came over who knows how, maybe 50, 60 years ago, and there are natural enemies in Europe, but natural enemies that evolved over hundreds of years, and we do not have the natural enemies in America yet that can kill Spotted Nap Weed and Leaky Spurg, but about 10 percent of Montana agricultural land is now out of production because this weed just takes over. It is like the Zebra Mussel. Nothing can kill it. It is terrible stuff.

We have a major problem in our State, and it just keeps spreading, and the biologists tell us that it is going to take a long time to introduce into this country native enemies from other countries. FDA has to take five or six years to quarantine them, make sure they do not cause other problems. In the meantime, we are trying to develop our own biological ways to control them, as well as chemical ways. It is a real problem, and I can sympathize with you, because these things, once they get out of hand, are very serious.

Senator GLENN. NBC had a feature, Mr. Chairman, back a few months ago, that I wish we had taken time to set up this morning here. We have a tape in the office. They did a survey of these things and showed some of the intake pipes and some of the boat hulls, and, as I have indicated here this morning, this is just an anchor line off of a little pleasure boat here this morning, and that is what happens in a short period of time, something like that.

The only natural predators that I have heard discussed were two, ducks and crayfish, certain types of crayfish. But there are just not enough ducks and crayfish to keep up with this. These Zebra Mussels proliferate and spread throughout the lakes far beyond the ability, at least for now, of the predators to keep up with them.

Senator BAUCUS. Thank you very much for your help. You have illuminated a very great problem, and hopefully we can find a solution.

Senator Metzenbaum, this is your part of the country, too.

OPENING STATEMENT OF HON. HOWARD M. METZENBAUM, U.S. SENATOR FROM THE STATE OF OHIO

Senator METZENBAUM. It sure is. As I was sitting here, it sort of occurred to me that, we go along, get involved in all of these big

business deals that are occurring, we see what has happened in the Savings and Loan situation, and meanwhile, coming along, no one paying that much attention— although now we are all paying attention—we see development of issues, such as AIDS, that nobody thought of 20 years ago; Alzheimer's, nobody thought of 20 years ago, and polluting the air, nobody thought of; the ozone layer, and then something that nobody is really thinking much of now. If you ask 240- some odd million Americans about Zebra Mussels, they would think that somehow it had something to do with the muscles on zebras, and nobody would really appreciate the impact.

I want to doff my hat to my colleague, as well as to Senator Glenn, who has drafted this important legislation, and to Senator Kohl, who is here as a cosponsor, I gather, and I am cosponsor as well. I want to commend both of you for your work in this area, and you, Mr. Chairman, for holding this hearing today.

We are talking about one of the most significant environmental catastrophes that has hit the Great Lakes in this century. Unfortunately, it is not one of those things that you can put something in the water and it is going to solve the problem. The cleanup and eradication efforts will cost maybe $500 million a year, and every community that draws water from a lake or a stream will have to fight a battle with Zebra Mussels. Cleveland, Detroit, Milwaukee, Buffalo, each have already spent tens of thousands of dollars to remove Zebra Mussels from clogged water pipes, and ultimately they will be spending millions.

The Fish and Wildlife Service say that this could cost $2 billion in damage to the commercial fishing industry over the next decade. This is such an unbelievable, unknown challenge that is sort of creeping up on all of the Great Lake cities and communities, that I think the faster we move with respect to this legislative approach, the better off it will be for all of us, the entire country.

I might say that we have always prided ourselves on the water resources that we have in the Great Lakes, and now we have the challenge that the cleaner the water, the more the Zebra Mussels are able to develop and spread.

I am glad that you, Mr. Chairman, have taken the time and effort to be with us this morning to chair this hearing. I pledge to you and to John and Herb that whatever can be done on my part, I will be there to pitch in and try to help.

Thank you very much, and thanks to both of you.

Senator BAUCUS. Thank you very much, Senator. I sense that this question is one that we should probably broaden. That is, there are many intentional and unintentional species that are introduced in this country. I have mentioned some plant species. This hearing revolves around animal species, and there are many other plant and animal species. I think we are going to need a better way to monitor, study, and figure out how we are going to control and deal with species that come into this continent from other continents.

I think it will be more and more of a problem as this country gets more and more interrelated and there is more and more transportation and whatnot, and we are probably going to have to broaden our inquiry here a little bit to include not only Zebra Mussels, but all species that potentially cause problems, whether they are intentionally or unintentionally introduced to this country.

Thank you very much. Thank you both very much, Senators.

I would like to call the rest of the witnesses up as a single panel, beginning first with the Honorable Constance Harriman, who is the Assistant Secretary for Fish and Wildlife and Parks for the Department of the Interior. Why don't you sit there in the middle, Connie?

Second, Dr. Alfred Beeton, Director of the Great Lakes Environmental Research Laboratory, Ann Arbor, Michigan; Dr. Gilman Veith, Director of Environmental Research Laboratory for the U.S. Environmental Protection Agency in Duluth; Captain Thompson, Chief, Report Safety and Security Division for the U.S. Coast Guard; Dr. Michael Donohue, Executive Director of the Great Lakes Commission; and Dr. James Carlton, Director of the Maritime Studies Program and Associate Professor of Marine Sciences at Williams College-Mystic Seaport, Mystic, Connecticut.

Okay.

STATEMENT OF HON. CONSTANCE B. HARRIMAN, ASSISTANT SECRETARY FOR FISH, WILDLIFE, AND PARKS, U.S. DEPARTMENT OF THE INTERIOR ACCOMPANIED BY GARY EDWARDS, ASSISTANT DIRECTOR FOR FISHERIES; JOHN STANLEY, DIRECTOR, NATIONAL FISHERIES RESEARCH CENTER, ANN ARBOR, MI; AND JAMES McCANN, DIRECTOR, NATIONAL FISHERIES RESEARCH CENTER, GAINESVILLE, FL

Ms. HARRIMAN. Good morning, Mr. Chairman. I have with me today three Fish and Wildlife Service personnel, and I would like to introduce them. They are Mr. Gary Edwards, who is the Assistant Director for Fisheries; Dr. John Stanley, who is the Director of National Fisheries Research Center, in Ann Arbor, Michigan; and Dr. James McCann, who is the Director of the National Fisheries Research Center, in Gainesville, Florida.

Mr. Chairman, I very much appreciate the opportunity to testify on S. 2244. I have submitted a written statement for the record, which I would now like to summarize.

The U.S. Fish and Wildlife Service has had extensive involvement with nonindigenous species issues over the years. The main mission of the National Fishery Research Center, in Florida, is to identify and track exotic fish species. The Fish and Wildlife Service's Great Lakes Center in Michigan is involved with nonindigenous species in the Great Lakes. It has been at the forefront of cooperative efforts to control the zebra mussel infestation.

The introduction of undesirable species into this country poses a problem that is both immense and immediate. It is a problem that has never been adequately addressed. The alarming spread of the zebra mussel throughout the Great Lakes is merely the most recent example of the havoc nonindigenous species could cause.

Because of the gravity and scope of the nonindigenous species problem, the Administration strongly supports the intent of the bill, but believes that it should be amended to broaden its scope and to increase its effectiveness.

The bill focuses on prevention of further unintentional introductions through ballast water management. In addition, a joint Fish and Wildlife Service/NOAA Sea Grant Program is authorized to

coordinate national research, prevention, control, and educational efforts associated with the zebra mussel and other aquatic nuisance species.

We feel that more comprehensive legislation is needed. It should include provisions on intentional introductions; it should authorize control programs for any undesirable nonindigenous aquatic species with greater specificity; and it should include guidelines for determining when control is warranted.

Preventing the intentional introduction of nonindigenous species could be based on an evaluation protocol. This approach is derived from procedures developed by fishery organizations and scientists in the early 1970s. It is used in Europe and has been used voluntarily in South Florida to evaluate the introduction of peacock bass. Unlike the injurious wildlife provisions of the Lacy Act, it would not involve a rulemaking for every species. Furthermore, the burden is placed on the proponent of introduction, not the Federal Government.

An evaluation protocol involves identification of the objective of the proposed introduction, followed by consideration of a range of species, especially native species, to accomplish those objectives. If there is no alternative to introducing the exotic species, attention is focused in advance of introduction on potential impacts and control methods.

This approach offers flexibility. The type of analysis and criteria used can vary depending on the circumstances. The protocol process incorporates both public scrutiny and peer scientific review.

Based on the Fish and Wildlife Service's experience with the injurious wildlife provisions of the Lacy Act, we feel that it is important to include input into the protocol process, not only from the proponents of introduction but also from other interested parties, such as Government, academia, and industry.

Preventing the unintentional introduction of nonindigenous species is more difficult. We believe it can best be handled by focusing on the methods of transmittal. In the case of the zebra mussel, for example, the focus would have been on treatment of ballast water, or, more generally, shipping and recreational boating.

In cases where undesirable introductions result in substantial adverse impact on ecology, industry, or human health, a control and eradication program should be developed. Each species warrants a carefully tailored strategy. One of the first steps should be to monitor the injurious species rate and direction of dispersal and the resulting impacts.

The proper role of the Federal and State governments is a difficult question. Clearly the States are essential participants. While the Federal Government shares responsibility for introduced organisms with the States, as a general matter, State fish and game agencies have primary responsibility for managing resident fish and wildlife resources.

We believe any effort to prevent introductions or to control proliferation must be a cooperative one between the States, the Federal Government, and other affected entities, including international organizations and foreign countries. In the case of the zebra mussel, for example, a logical partnership would include the States,

the Fish and Wildlife Service, NOAA-Sea Grant, Canada, the Great Lakes Fisheries Commission, and industry.

In conclusion, I applaud the committee's efforts. S. 2244 is timely, and it is definitely headed in the right direction. In light of the complexity of the nonindigenous species problem, I have directed the Fish and Wildlife Service to continue to work with your committee, the International Association of Fish and Wildlife Agencies, NOAA, the U.S. Coast Guard, and other interested parties to develop further recommendations and strategies.

Thank you again for the opportunity to testify.

Senator BAUCUS. Thank you very much, Secretary Harriman, for that comprehensive statement.

I have to leave to go to another hearing. Senator Metzenbaum will chair the rest of the hearing.

You all have obviously raised a very important issue that we are going to have to deal with this year. I want to thank you very much for your testimony.

Senator Metzenbaum [assuming Chair]. Thank you.

Our next witness is Dr. Gilman D. Veith, Director of Environmental Research Laboratory, at the U.S. EPA.

I am happy to have you with us, sir.

STATEMENT OF GILMAN D. VEITH, DIRECTOR, ENVIRONMENTAL RESEARCH LABORATORY, ENVIRONMENTAL PROTECTION AGENCY

Mr. VEITH. Thank you, Mr. Chairman and members of the subcommittee.

This bill, S. 2244, is taking a necessary step in controlling problems that are created when human activities or our technology brings isolated ecosystems together. We feel that the findings of Congress in this legislation agree well with the data that is available to EPA.

The laboratory I manage in Duluth, Minnesota, is responsible for establishing water quality standards and water quality criteria for the Nation's fresh waters, and for managing the research necessary for EPA's responsibilities under the Great Lakes Water Quality Agreement.

Under that Water Quality Agreement between the U.S. and Canada, EPA has several programs which can be brought to bear on the issue of the Zebra Mussels in the Great Lakes and in other surface waters. Our role in the Great Lakes International Surveillance Program seeks to establish long-term status and trends information to guide public policy. We have a longstanding working relationship with the other agencies, such as NOAA and U.S. Fish and Wildlife Service and the great lakes community. This year we expect to expand the Great Lakes Surveillance Program by merging it with a program EPA started in 1990, called EMAP, which is an Environmental Monitoring and Assessment Program.

This program will set up a monitoring strategy to measure the ecosystem health with a holistic perspective. It will establish a long-term status and trends monitoring program on the health of systems across the country. We will form a program called EMAP Great Lakes in 1991 to develop methods of statistically monitoring

the status and trends of this species (zebra mussels) throughout the Great Lakes, particularly with respect to the ecosystem impacts that are found in aquatic communities.

The EPA has another strong role under the Great Lakes Water Quality Agreement, and that is to develop models or the scientific underpinnings which are needed for lakewide management planning, taking an ecosystem perspective to the management of our Great Lakes.

The scientific underpinnings of the lakewide management plan will center around a series of ecosystem models and mass balance models which have been tested in Lake St. Clair, the upper-connecting channels region, in Green Bay this year, and will be scheduled to start whole lake modeling in 1991. These models try to link management options for Great Lakes issues with the models of how the ecosystem will respond. The best known example of this is the eutrofication models which were used to correct the problems of eutrofication in Lake Erie and control phosphorus in Lake Erie when many people thought the lake was dead. We are now applying these to toxic chemicals, to try to examine various control options.

We believe that the Zebra Mussels are affecting the plankton assemblages and the ecosystem dynamics sufficiently that they may actually change the fundamental processes going on within the ecosystem. We feel that this needs to be researched.

My Assistant Administrator in the Office of Research and Development has allocated resources in 1990 to host a workshop, which we hope to be an international workshop, and certainly with numerous Federal agencies and State agencies, and hopefully this September. The purpose of this workshop is to provide a public forum for scientific experts from Government, universities, and industry to present their early results of the investigations on Zebra Mussels in the ecosystem, and we hope that the results of this workshop will assist us in designing a proper network for monitoring, as well as guiding some of the other activities needed to control Zebra Mussels.

EPA has, as I have said, already underway programs which bear on the goals of S. 2244, and which in fact encompass related and broader goals. We observe that the research can be done most effectively——

Senator METZENBAUM. Can you wind up, please, Mr. Veith?

Mr. VEITH [continuing]. Research can be done most effectively if there are no constraints on the physical location or organizational affiliations of the scientists involved. In particular, as we noted above, EPA as well as the Departments of Commerce and Interior are currently conducting research in this area. The Administration position is that the funding authorized in this bill should therefore be changed to "such sums as may be necessary."

Senator METZENBAUM. Up or down?

Mr. VEITH. I think the point is that EPA would prefer not to have it spelled out who does what in the Great Lakes community. The approach—EPA believes that this approach would give the departments and the agencies involved in this issue, including EPA, time to develop a comprehensive program.

Senator METZENBAUM. Sounds like gobbledy-gook, Mr. Veith. It does not sound like you are saying anything. You are just saying,

"Don't do anything." Do you think there is enough in this bill? Do you want more? Do you want less?

Mr. VEITH. I am not prepared to answer that question. The recommendations, we feel, could be handled through the normal annual budget process. We defer to the Departments of Commerce and Interior for all other provisions of the bill.

Ms. HARRIMAN. Excuse me, Senator. I just wanted to offer a comment on how the Fish and Wildlife Service is——

Senator METZENBAUM. Please proceed.

Ms. HARRIMAN. Generally, the Fish and Wildlife Service believes that the situation is moving so rapidly that it is difficult to lock into a specific number, but as far as the $5 million figure that is in the bill, to apply to the Fish and Wildlife Service, I think that we feel it probably should be a higher number.

Senator METZENBAUM. Higher?

Ms. HARRIMAN. Yes.

Senator METZENBAUM. Thank you.

Captain Thompson, I am happy to have you with us. You are Chief of Port Safety and Security Division of the Coast Guard Headquarters in Washington.

STATEMENT OF CAPT. T.E. THOMPSON, CHIEF OF PORT SAFETY AND SECURITY DIVISION, U.S. COAST GUARD

Captain THOMPSON. Good morning, Mr. Chairman, distinguished members of the subcommittee.

I would like to thank you for the opportunity to speak to you regarding the Nonindigenous Aquatic Nuisance Act of 1990.

The Coast Guard recognizes that the introduction of nonindigenous species in the U.S. waters is an immediate problem that needs definitive action. Therefore, the Coast Guard supports in concept Title 1 of S. 2244.

The problem is global in nature. Other countries that are involved and are being affected, to include a few that I think will be spoken to later, are Australia, Chile, Norway, the Union of Soviet Socialist Republics, Canada, and the United States. Two countries, Canada and Australia, have already initiated voluntary control programs which impact domestic and foreign flag ships and international transport.

Recently, as this hearing as been focusing on, the Zebra Mussel has become a problem in the Great Lakes. The Canadian Government, in full consultation with the United States, the Great Lakes Fisheries Commission, and representatives of the commercial shipping industry, in 1989 implemented voluntary guidelines for controlling the discharge of ship ballast water in the Great Lakes.

In view of the health and economic impact resulting from the introduction of nonindigenous species in the United States and other countries around the world, this matter has been raised at the International Maritime Organization's (IMO) Marine Environment Protection Committee (MEPC). IMO is the United Nations' specialized agency for maritime affairs. In 1988, member governments were invited by IMO to submit relevant information, and IMO concluded that this is an international problem which requires an international solution.

The MEPC agreed to form a working group to draft international standards at its next meeting in November 1990. The IMO also requested that its member governments urge compliance with the current voluntary guidelines.

The United States is taking an active role at IMO towards the development of uniform global standards. We are also working with Canada in formulating a bilateral program for the Great Lakes. Due to the nature of this problem, we believe there must be a program that covers all vessels capable of introducing nonindigenous species by ballast water.

In order to achieve an ordered, well thought out, and effective program, we would recommend a program consisting of three distinct phases.

Phase one would be a voluntary program in the Great Lakes that is compatible with the Canadian program. This would result in a standardized approach and prevent the impression that the U.S. is taking unilateral action on an issue that affects both nations.

Phase two would consist of a mandatory ballast water exchange or treatment program for the Great Lakes.

Phase three would then mandate a nationwide ballast water control program, or pursue some other acceptable alternative to ensure that ballast water discharged from vessels is free from nonindigenous species.

The intent would be to employ a performance-oriented rather than engineering-specific criteria. Each phase of this three-phase program would build upon the results of research and experience concerning the control options, as well as the results of the international standards.

We have previously made some administrative comments, Mr. Chairman. I would like to expand on those a little bit.

We believe that the six-month time period to promulgate regulations is too short, given the complexity of this issue and the extensive time period required in the regulatory process.

Although ballast water exchange at present seems to be the most promising alternative, there are issues with regard to ship safety, economics, and biological effectiveness that need to be addressed.

For instance, there is the negative impact on stability of a ship as a result of the free surface effect when a ballast tank is only partially filled. There are also possible hull bending stresses when a ballast tank is emptied or filled. Crew fatigue, as a result of extra workload, is also a concern.

The effectiveness of ballast water exchange should also be determined. Sediments often remain in a ballast tank after an exchange, and even though you put seawater in, they could still be introduced into the Great Lakes.

Other options meriting further research include high velocity water flow, filtering, heating, or chemical treatment of some nature.

We also believe that the funding authorized in the bill should be changed to such sums as may be necessary, as this approach will give the departments and agencies time to develop a comprehensive program that details our needs more accurately.

In conclusion, sir, in the long run, the Coast Guard believes that a fully integrated international strategy will be most effective.

We agree with Ms. Harriman that such a program should be one that includes coordinated strategies for introduction of all aquatic organisms, including those introduced for intentional release or for culture, as well as those introduced unintentionally through ship's ballast or other means.

Thank you, Mr. Chairman.

Senator METZENBAUM. Thank you very much.

Our next witness is Dr. Michael Donahue, Executive Director of the Great Lakes Commission from Ann Arbor. Happy to have you with us, Dr. Donahue.

STATEMENT OF MICHAEL DONAHUE, EXECUTIVE DIRECTOR, GREAT LAKES COMMISSION, ANN ARBOR, MI

Mr. DONAHUE. Thank you. I am pleased to be here on behalf of the eight member States of the Great Lakes Commission to speak to the problems concerning the infestation of the Zebra Mussel and other nonindigenous aquatic nuisance species. I will submit a detailed statement for the record, and will summarize very briefly at this point in time.

By way of background, the Great Lakes Commission is an interstate compact agency founded in State and Federal law. Its members include the eight Great Lakes States, and our mission is to develop policies and advocate them at the Federal and Congressional levels relative to economic development, resource management, and environmental quality.

The Great Lakes Commission notes that crisis response measures for Zebra Mussel research, monitoring, and control are already in place in the region to some modest degree at the local, State, provincial, and Federal levels, and there are a variety of task forces and less formal networks underway.

Although such efforts are laudable, we believe they are inadequate. They are piecemeal, poorly coordinated, and directed almost exclusively at crises rather than long-term control options. We believe that a tremendous amount of expertise is available in the region, but we have yet to see any indication of a single coordinated and unified strategy that blends research, monitoring, and control activities on a basin-wide level.

While such a strategy would appear to be of monumental dimensions, we need only remind ourselves that we are also addressing a problem of monumental dimensions.

The problem is not just a biological one, it is an institutional one. We believe an immediate need exists for Federal leadership in the form of Federal law that establishes a strong, action-oriented, coordinated framework with a primary focus on the development and application of control strategies.

The Great Lakes Commission fully supports the intent of Senate Bill 2244. We believe it establishes an aggressive program that provides a framework for multi-jurisdictional coordination, and appropriate means to balance research, monitoring and control efforts.

We note several strengths in the legislation that should guide any and all legislative program and policy initiatives. Very briefly, we are pleased that the legislation does not have a specific focus on the Zebra Mussel, but has a broader focus on nonindigenous species

in general. We are pleased that the legislation recognizes this as a national and international issue rather than just a Great Lakes issue.

As I mentioned before, the challenge has both a biological and institutional dimension, and we are pleased that the coordination framework provided for in the legislation will help insure a multi-jurisdictional and multidisciplinary approach to the problem.

We are pleased that the legislation has an emphasis on environmentally sound control options, recognizing that ill-conceived, quick fix solutions, chemical or otherwise, may very well create as many problems as they solve.

We are also pleased that the legislation recognizes public information and education as a key component in efforts to control or prevent the transport of Zebra Mussels and other nonindigenous species.

While the Commission is emphatic in its support for this bill, we believe that several comments and suggestions are in order that will help strengthen the language and enhance the effectiveness of subsequent programs.

First of all, even though an elaborate coordination structure is critical for the bill, we need to realize that coordination alone is not going to solve the problem. Every effort must be made to ensure that this structure is only a means to a more important end, the actual control or eradication of the Zebra Mussel and other nonindigenous species.

We like the National Cooperative Action Group idea and the regional focus through the Regional Commissions. We do believe, however, that the presence and stature of both the U.S. Environmental Protection Agency and the U.S. Army Corps of Engineers needs to be enhanced under that framework.

We at the Commission, for example, are fully supportive of the Corps' proposed Great Lakes Environmental Action Program, and believe that this is an opportunity for the Corps to focus its abilities in a particular environmental protection area.

We would advocate flexibility in the composition of the Regional Commissions—for example, to provide for representation from commercial shipping and port interests, and also to provide for at-large membership for individuals with particular expertise.

We also believe the member States of the Great Lakes Commission can play an important role in this effort, and some type of grant program or technical assistance to the States would be in order.

Echoing Senator Glenn's comments, we believe that a new and separate Regional Commission may not be necessary in the Great Lakes Region. We would invite you to consider the Great Lakes Commission as an existing entity with a track record in Federal, State, and Provincial coordination to serve in that role and avoid some of the bureaucratization of the control effort.

Finally, we believe that the section providing for interactions with foreign countries addresses an important need, but does not go far enough. We are concerned with the lack of U.S.-Canadian cooperation to date, and believe that that section might be strengthened to provide Canada with actual representation as members or

observers to the Regional Commissions and the National Commission overseeing them.

In conclusion, we at the Great Lakes Commission believe there is a tremendous flurry of legislative program and political activity relative to the Zebra Mussel issue. We believe this level of activity should be a catalyst, not an impediment for progress. This is an important opportunity to act on our rhetoric of Great Lakes partnership, and we believe this bill can go a long way in that direction.

Thank you.

Senator METZENBAUM. Thank you very much, Dr. Donahue.

Dr. Beeton, Director of the Great Lakes Environmental Research Laboratory at Ann Arbor. I am happy to hear from you, sir.

STATEMENT OF ALFRED BEETON, DIRECTOR, GREAT LAKES ENVIRONMENTAL RESEARCH LABORATORY, ANN ARBOR, MI

Mr. BEETON. Thank you, Mr. Chairman, members of the subcommittee. I am Alfred Beeton, Director of the Great Lakes Environmental Research Laboratory of the National Oceanic and Atmospheric Administration, U.S. Department of Commerce.

I appreciate the opportunity to testify on S. 2244 and to discuss the present and possible future impact of the Zebra Mussel, and other exotic species on the Great Lakes and other aquatic environments.

Exotic, nonindigenous species are not new to the Great Lakes. Some are beneficial, such as the several kinds of salmon, the brown trout, the rainbow trout. Some exotic species are of minor concern, such as the flounder and the Chinese Mitten Crab. Others continue to arrive, as we heard earlier this morning. The Tube Nose Goby was discovered in the Detroit River just a few weeks ago. It is an endemic species to the Black Sea and apparently got here through ballast water.

Some of these exotic species are especially detrimental. They can compete for habitat, such as the Spiny Water Flea; they can compete with the native species for food, such as the River Ruff; they interfere with the native species' reproduction, such as the Zebra Mussel. They alter the food web, and here both the Spiny Water Flea and the Zebra Mussel alter the food web. They can be voracious predators, such as the Sea Lamprey, and they interfere with beneficial uses of the resource, such as clogging water intakes, attaching to boats, littering the beaches, and so on.

The Zebra Mussel undoubtedly will have major, perhaps catastrophic, economic impact wherever it spreads. They are prolific fouling organisms, and corrective measures will be very costly. Power plants, municipalities, factories, boat operators, and commercial vessels must deal with clogged intakes, fouled hulls, and engine cooling damage.

Every day we have 655 billion gallons of water withdrawn from the Great Lakes. Approximately 94 percent of that is used in electric power generation, so there is a tremendous potential for impact of this organism on the water intakes.

Research is needed in order to develop ecologically sound mitigation and control measures, and NOAA's Great Lakes Environmental Research Lab has already started such research. A study has

been underway in cooperation with the U.S. Coast Guard and Sea Grant on the spread of the organism. Also, NOAA can assist in the coordination and advisory service via their Sea Grant Program and interacting with the Great Lakes Commission and the Great Lakes Fishery Commission.

In fact, two meetings were recently held, the latest on June 6, with the Great Lakes Commission, the U.S. Fish and Wildlife Service, Sea Grant, and with representation from EPA, and this meeting led to an agreement to establish a U.S. coordinating committee for exotic species research and advisory service program.

We find it highly desirable for any major program focused on exotic species to have very close collaboration and participation by NOAA, EPA, U.S. Fish and Wildlife Service, the Coast Guard, Corps of Engineers, State agencies, the electric power industry and municipalities, and academic institutions. Certainly, there must be interaction with our counterparts in the Canadian institutions.

I would be happy to answer any questions.

Senator METZENBAUM. Thank you very much. I appreciate your statement, Dr. Beeton.

The last witness is Dr. James T. Carlton, Director of the Maritime Studies Program and Associate Professor Marine Sciences, Williams College-Mystic Seaport, Mystic, Connecticut.

STATEMENT OF DR. JAMES T. CARLTON, DIRECTOR, MARITIME STUDIES PROGRAM AND ASSOCIATE PROFESSOR OF MARINE SCIENCES, WILLIAMS COLLEGE-MYSTIC SEAPORT, MYSTIC, CT

Mr. CARLTON. Thank you, Mr. Chairman, and thank you for the opportunity to address these issues. I am a marine ecologist, and Director of the Williams College-Mystic Seaport Maritime Studies Program.

My research since 1962 has focused on alien aquatic species. I have studied ballast water since 1980. I am the head of a Sea Grant-funded laboratory at the University of Oregon's Institute of Marine Biology, focusing on ballast water as a dispersal mechanism for living aquatic organisms. I am also co-principal investigator of a new ballast water study, funded to date by the Canadian Government and located on the St. Lawrence Seaway.

In Oregon we have found over 300 species of living animals and plants in ballast water coming from Japan.

Our Canadian Laboratory focuses on the ballast water now entering the Great Lakes from Europe and elsewhere, specifically in compliance with the Canadian Coast Guard's ballast water exchange guidelines, and the effectiveness of high seas exchange. Our field personnel began sampling ships just 15 days ago.

What is the problem here? The problem is that North America has been invaded by Zebra Mussels, and ballast water, astronomical levels.

As we do not yet understand all of those processes that regulate invasions, it makes sense to regulate those processes that facilitate the transport of the invaders, and those processes are ballast water.

The bottom line is that as long as there is ballast water being released, the door is open for new invasions.

Is ballast water an important issue, or is the Zebra Mussel invasion a rare and isolated event? It is an important issue. It is not a rare event, but it is hard to see it through all of the other enviro-disasters of acid rain, medical beach waste, and global warming. Ballast water became big news in the 1980s around the world. Perhaps it was because the amounts of ballast water carried and the speeds of ships increased considerably. Perhaps it is because the waters here and there are less polluted.

Whatever the reasons, we are now witnessing new invasions on a grand scale around the world. Red tides in Australia, Chinese clams in San Francisco Bay, American comb jellyfish in the Black Sea, and, of course, the freshwater organisms from Europe in the Great Lakes, the Ruff, the Spiny Water Flea, the Zebra Mussel. There are others. We believe that more ballast-introduced species are in the Great Lakes that we have not yet discovered.

The spigot can be cranked down to prevent the release of astronomical levels.

The spigot can be cranked down to prevent the release of ballast water organisms. Open ocean exchange will go a very long way in removing from these biological conveyer belts many potential invaders. The passage of this bill will help further protect coastal zone environments which we strive to protect through other means. Coupled with this is the critical need to know about the ecological and economic impact of aquatic nuisance species, to mount research efforts aimed at controlling these species, and to educate the public about what is being and can be done to minimize the impact and spread of these nonindigenous organisms.

These efforts are now widely-scattered and poorly funded among hundreds of different agencies and departments. A focused national program would save many years and many tens of millions of dollars.

The Zebra Mussel is with us forever. It is important that we not appear before you one year from now and have to say that about yet another species.

Thank you.

Senator METZENBAUM. Thank you very much, Dr. Carlton.

I am happy that Senator Chafee has joined us.

Senator Chafee, do you have any opening statement?

OPENING STATEMENT OF HON. JOHN H. CHAFEE, U.S. SENATOR FROM THE STATE OF RHODE ISLAND

Senator CHAFEE. I have, Mr. Chairman, but I will just put it in the record. Thank you, Mr. Chairman.

[Senator Chafee's statement follows:]

OPENING STATEMENT OF HON. JOHN H. CHAFEE, U.S. SENATOR FROM THE STATE OF RHODE ISLAND

Mr. Chairman, the legislation which we are considering at today's hearing addresses a complicated and interesting problem of national and international significance. I thank the Chairman for providing this opportunity to hear from the experts on the issue of introduction of nonindigenous species and specifically, the problems associated with infestation of zebra mussels in the Great Lakes.

It seems to me that given the high rate at which the zebra mussel reproduces and the hearty nature of the species—I understand it can survive out of water for up to 14 days—it will be virtually impossible to control or prevent its spread throughout

much of the United States and Canada. Due to the zebra mussels capacity to filter large volumes of water each day, there is great potential for adverse effects of this infestation on fish and wildlife resources. Also, the economic consequences associated with clogged municipal, industrial and power plant intake systems are significant. I look forward to hearing from our witnesses regarding the potential for controlling the spread of the zebra mussel and other nonindigenous species that are already well established.

Ballast water is one of the most important and evident conduits through which aquatic species are transported from ecosystem to ecosystem. Thus, the Glenn bill requires the Coast Guard to promulgate regulations requiring ships to carry out a high sea exchange of ballast water before releasing any ballast water in U.S. waters. While this appears to be a logical prevention mechanism, we need to learn more about the efficacy and safety of a high sea ballast water exchange requirement as a means of preventing introduction of nonindigenous aquatic species. I hope the agencies will also comment on how to eliminate other ways in which aquatic and nonaquatic species are introduced into foreign ecosystems.

Solutions for controlling the spread of the zebra mussel and other exotic species will require a cooperative approach between nations, states, shippers, industries, organizations and individuals. S. 2224 seeks to establish new groups and new regional commissions to lead and coordinate this interaction. Given the urgency of the zebra mussel issue, it strikes me that it may make sense to use existing bodies to address this problem. For instance, could the existing Great Lakes Fishery Commission or Great Lakes Commission be directed to examine the zebra mussel problem rather than creating another regional commission under the authority of this legislation?

While the zebra mussel is a particularly striking example, unintentional and intentional introductions of exotic species have created problems for centuries. In developing a national approach, we need to look at improving regulation and analysis of intentional introductions and at establishing an effective program for limiting and controlling unintentional introductions.

I look forward to hearing from our witnesses and to working with the Chairman, Senator Glenn and others on an appropriate national program to prevent and control infestations of nonindigenous nuisance species.

Senator METZENBAUM. Ms. Harriman, let me ask you to outline the current activities undertaken by the Fish and Wildlife Service to control Zebra Mussel infestation in the Great Lakes, and how much money has the Service expended this year and in the past years to support the fight against Zebra Mussels?

Ms. HARRIMAN. I can answer that question in general terms first, and then I am going to defer to Dr. Stanley to give you more specifics.

In general terms, the Fish and Wildlife Service has concentrated on research and monitoring efforts, tracking the biological history of the zebra mussel, and looking at things like the likely circumstances under which the zebra mussel will spread and will establish itself.

Dr. Stanley?

Mr. STANLEY. I am Dr. John Stanley, Director of the National Fisheries Research Center, Great Lakes, in Ann Arbor, Michigan.

In fiscal year 1990 we are spending $94,000 on a zebra mussel research project that includes looking at some natural enemies of zebra mussels in the Great Lakes. We have discovered that freshwater drum will feed on zebra mussels. Additionally, the crayfish will eat the very tiny spat soon after they are settled. We have observed a large increase in diving ducks that stay over in the Great Lakes in the fall of the year feeding on the mussel.

So far none of these animals are abundant enough to make a dent in the tremendous populations that occur there, but we hope to develop models that would show us whether or not encouraging these populations would be of benefit. I do have a picture here of some diving ducks. At one time, the lakes did not have these diving

ducks in the fall, and now literally thousands of these stay in the Great Lakes Region way into the fall, when previously they migrated south to areas such as Chesapeake Bay.

Senator METZENBAUM. Did I understand you right? You said $94,000?

Dr. STANLEY. That is correct, sir.

Senator METZENBAUM. That is the lowest figure I have heard in this institution in connection with any matter. [Laughter.]

Dr. Carlton, what are you doing, if anything, relating to the monitoring of ballast water exchanging?

Dr. CARLTON. The project that we began just two weeks ago is to examine ships that have exchanged their ballast water on the high seas, and to see if there are still residual organisms left in the ballast water, in the ballast tanks, that have not been flushed out on the open ocean.

In addition, we are also going to be sampling any ship that comes in, whether or not they have exchanged their water, to assess what kinds of organisms continue to be released in the Great Lakes. We just began that project, and began sampling ships just two weeks ago, and we do not have any results at the moment.

Senator METZENBAUM. How do we stop the spread of exotic species which have already infested U.S. waters?

Dr. CARLTON. It has never been done before. It is very difficult to stop organisms, whether they are mussels, fish, or aquatic plants that can take advantage of numerous mechanisms of dispersal.

For the Zebra Mussel, there are 15 to 20 different ways for it to actually leave the Great Lakes and spread rather rapidly across the country. I think it is not a matter so much of stopping it, it is an understanding of how to slow it down. It is not so much whether or not it will spread, but how fast.

Senator METZENBAUM. Captain Thompson, the Coast Guard has been studying the ballast water exchange. Do you think that that area of exploration is a viable option for keeping exotic species out of the Great Lakes?

Captain THOMPSON. I think, sir, that ballast water exchange is a viable option, and probably one of our most promising, as Dr. Carlton has been discussing. I would not hold out ballast water exchange as a panacea for preventing further introduction of species into the Great Lakes. There are other vectors available. Possibly the clingage to the hull growth may be one; clingage to anchor cables and in anchor chain lockers.

Senator METZENBAUM. What is that first word?

Captain THOMPSON. Clingage.

Senator METZENBAUM. Clingage?

Captain THOMPSON. Yes, sir.

Senator METZENBAUM. Do you want to explain that?

Captain THOMPSON. Where the mussel or organism imbeds itself on the anchor chain, such as Senator Glenn had the anchor rope with a lot of mussels on it.

They may also be found possibly even in the cargo aboard a ship; could be in the fire main or other cooling systems. There are other vectors besides ballast water, but I think ballast water exchange or treatment of some sort would probably go a long way towards solving part of the problem, at least.

Senator METZENBAUM. How are the Canadian and Australian programs working?

Captain THOMPSON. The Canadian program is being analyzed at this point, sir. We do not have the results of that. Initial indication is that 85 percent of the ships are complying with the voluntary nature of the program. The Australian program started out to be a mandatory ballast water exchange program, and the Australians found that they did not have administrative control over that. They have gone to what they call a voluntary program that gives the vessel the option of treating, exchanging or not discharging the ballast water, and they are having more success with that, but I cannot answer that question right now. I would like to answer it later for the record, sir.

[The Coast Guard supplied the following:]

Senator METZENBAUM. How are the Canadian and Australian programs working?
Answer. Further research is being conducted and an answer will be provided at a later date.

Senator METZENBAUM. Would it be helpful if the ballast water were exchanged out in the ocean?

Captain THOMPSON. In an instance where ballast water comes from a freshwater source and is destined for the Great Lakes, and you are exchanging fresh water for salt water, there would be a greater effect, a better effect of preventing an introduction into the Great Lakes. When we start talking about introduction of nonindigenous species into other salt water ports, such as San Francisco—Dr. Carlton mentioned there is a species that was introduced there—then changing salt water in the middle of the ocean would probably have less of an effect. We do not know exactly what that is now, sir.

Senator METZENBAUM. Senator Chafee, questions?

Senator CHAFEE. Thank you, Mr. Chairman.

I have some questions of the entire panel, but first I want to commend Ms. Harriman. I read over your statement. I thought you had some constructive suggestions for us on the committee on how to deal with this legislation. You are pointing out that this bill sets up 20 regional commissions, does it not?

Ms. HARRIMAN. That is correct.

Senator CHAFEE. I hope we can onsider the suggestions you have made.

Let me just ask a question of the group here. I read that, amongst the other things that this Zebra Mussel does, it filters the water, something about each mussel filters a quart of water a day, and then it said that, as a result, there is greater water clarity. Is that a plus? Is there any good out of all of this? So what? What is water clarity? Just clear to look through and just as pretty? Dr. Beeton?

Mr. BEETON. Yes. I might answer that, because we have had a study that was going on from 1983 through 1987, looking at year-round samples in Lake Erie on the nutrients and plankton, and we started that study up again this spring because we were very concerned what changes may be occurring, especially because of this reference to increased clarity. And in looking at plankton samples that we have collected weekly, starting April 9, in some samples, it

looks like the plankton is almost gone. Where you had as many as 10,000 or 12,000 algal cells per milliliter in the early 1980s, now you may have only 100.

What that means is this is altering very radically the food chain. The algae are at the base of the food chain, and important for the fish food organisms. If this trend that we are seeing continues, that is going to be a drastic impact on the whole biota of Lake Erie.

Senator CHAFEE. So, there is no plus to greater clarity, is there?

Mr. BEETON. Well, there could be some plus from the standpoint that in some areas it would help promote the growth of macrophytes.

Senator CHAFEE. Of what?

Mr. BEETON. Macrophytes; the aquatic plants, the rooted aquatic plants. But that would not——

Senator CHAFEE. That is really not a plus, though. That would not help the food chain, would it?

Mr. BEETON. That would not help the food chain very much because the population of fish in Lake Erie is primarily based upon food chain that relies on algae.

Senator CHAFEE. It seems to me that the Zebra Mussel is a total disaster any way you look at it.

Mr. BEETON. That is the way it appears that it is evolving, very definitely.

Senator CHAFEE. The only natural prey you have discovered so far, as I understand it, is certain ducks. What kind of ducks?

Mr. BEETON. Diving ducks.

Ms. HARRIMAN. Canvasbacks, I think, are one.

Senator CHAFEE. So it helps the canvasbacks, but that's the only thing. How do they get a hold of these? I have seen samples of mussels that latch on. Can they pluck them off?

Ms. HARRIMAN. Yes.

Senator CHAFEE. So, obviously, we want two things here. We want prevention, and do not have these things occur again, and that deals with monitoring the change of the ballast water in these vessels if we can, and the other is to do something with the Zebra Mussel, either discover a natural enemy or import an enemy, and that always has problems. You import an enemy, you do not know what the import is going to do.

Was not the lamprey eel a terrible problem out there on the Great Lakes?

Ms. HARRIMAN. Yes, it was.

Senator CHAFEE. I may be repeating what was asked here.

Ms. HARRIMAN. No, no, you are not. In fact, I was going to mention that when people were talking about control. I am a member of the Great Lakes Fisheries Commission, and I think that we have made progress in that area. The sea lamprey used to be a major, major problem. However, it is sort of a tentative victory, because what we have been relying on to control the sea lamprey is lampricide.

Senator CHAFEE. Lampri, what?

Ms. HARRIMAN. Lampricide, a chemical. People are concerned about the use of chemicals today. Furthermore, there is only one company in the world that makes this lampricide, and therefore our supply is somewhat uncertain. We have been relying heavily

on lampricide, and the focus now is beginning to shift more to biological solutions such as sterilization programs, and other solutions, like barrier dams. We are feeling that we are really under the gun again.

Senator CHAFEE. I thought we proclaimed victory over the lamprey eel, had we not?

Ms. HARRIMAN. Well, some people may. I would not. I would say we have made definite progress, but I do not think the final chapter has been written.

Senator CHAFEE. That is even more discouraging. This is a bad day here.

I look on this as a tremendous crisis we are facing. In a way, I am kind of curious that it has not happened earlier, that we have not had ships come from the Black Sea. After all, discharging ballast is uncontrolled so far, is it not? So it is amazing that we have not had to face up to this problem before, but when you take one look at this, which I suppose is just typical as a clam shell with all of these Zebra Mussels attached to it, we have a real problem on our hands.

Particularly, I find the blocking of intake pipes a problem, but that is something somehow I have a feeling we will be able to wrestle with, but if it is taking the algae out of the water, and thus destroying the whole food chain, we have real difficulty. Here is what it looks like when the—well, I do not know what we are going to do about it, but we will do the best we can to be helpful.

Thank you, Mr. Chairman.

Senator METZENBAUM. Let me ask any one of the panel, has anybody come up with any ideas as to any positive value from the Zebra Mussel? You can use it for any one of 1,000 different things, such as road material, such as construction? Has anybody thought whether there is anything in the composition of the Zebra Mussel that might have some pluses to it?

[No response.]

Senator METZENBAUM. Let the record reflect there was a resounding silence.

Ms. HARRIMAN. Silence.

Mr. BEETON. Mr. Chairman, I think it is too early to really say. Perhaps it might have some beneficial uses, but, right now, all we see are the detrimental aspects, but there are few people that are making some jewelry and things like that, but it is such a minor thing that it is not worth considering. I think one small restaurant on Put-in-Bay has tried some kind of a Zebra Mussel soup or something, but those are very minor things.

We really have not gotten into that kind of research yet, and I suspect that that would be considered possibly through some of the academic researchers in the Sea Grant Program.

Senator METZENBAUM. I have often felt that sometimes out of negatives there are some positives that may be found. It would seem to me that just conceivably mussel, maybe somebody can find something positive about this mussel, that at least would make Senator Chafee and I feel a little bit better about it.

Mr. BEETON. Well, I hope so. I certainly want the Senator to feel better than he does right now about this problem. It is a bad problem.

Senator METZENBAUM. I have no further questions.

Senator CHAFEE. Mr. Chairman, could I ask one question, if I might, before you wind up?

Senator METZENBAUM. Sure.

Senator CHAFEE. Obviously, they have wrestled with this problem for a long time in Europe, not only in the Soviet Union, I presume, but, as I read the background material that talked about spreading up through the canals, and there are canals all through Europe, what do they do? What is the European experience? Have we talked to them?

Ms. HARRIMAN. I know one thing that they are doing. In essence, they are designing around it. They are engineering and constructing infrastructure that takes into account the zebra mussel, and it is designed in such a way so as to inhibit the spread. For example, in their intake pipes, they have faster water flow.

Senator METZENBAUM. They have what?

Ms. HARRIMAN. They have a monitored water flow, a faster water flow through their intake pipes. The way they construct the infrastructure and the water flow, the speed of the water that they allow in the infrastructure, takes into account the zebra mussel, and I think that is one of the ways that they have dealt with the zebra mussel problem.

Senator CHAFEE. First of all, it seems to me, whoever is going to head up this research project should find out what the Europeans are doing. They are no dumbbells. They have wrestled with this for some time.

Secondly, I wonder what they have done to struggle with the fact that their Zebra Mussels obviously must filter the algae out just like is happening in the Great Lakes. What is the result?

Finally, as I read the material, I think we have a terrible future problem on our hands. As I understand, these mussels can survive out of the water for 14 days. Any outboard motor boat on a trailer that somebody takes into Lake Erie, and then, before you know it, they are going to be in Saranac Lake, New York, or to the south or wherever, so this is going to be all over the Nation before we know it, if the facts are as you indicate, and I have no reason to quarrel with that.

Mr. BEETON. Mr. Senator, there have been reports that the Zebra Mussel has spread to three small lakes in Ontario, and one lake in the State of New York. There is also, you know, speculation about spread elsewhere, that has not been confirmed, and, as far as the situation in Northern Europe, one of the things that should be kept in mind is that in many places in Northern Europe, Zebra Mussels had spread there by 1840, and so that many of the structures and the intakes that they built were built to accommodate the Zebra Mussel.

For example, in one of the power plants, the cooling water comes in one channel and then they can discharge the hot water through another intake channel and alternate between the two, and that way it will cut down on the establishment of the Zebra Mussel in the cooling water intake.

They have had the opportunity to accommodate this organism over many years, and our problem is we already have the infrastructure in place that was not designed to deal with the problem.

Very certainly, as part of our activities that would be funded through 2244, I am sure that my agency and the other agencies would be looking at what the Europeans have been doing and we would certainly be interacting very closely with them on this total problem.

Senator CHAFEE. Well, I see as a greater problem the inflow, the destruction of the algae and the whole food chain. To me, in the long run, that is probably even worse because we see a solution. In some way, man can come up to its design solution to the clogging of the intake, probably, at least they seem to have done so in Europe. What about the food chain?

Mr. BEETON. You are absolutely right, and that is where we would propose to focus most of our research in cooperation with the Fish and Wildlife Service and EPA. That is definitely needed.

Senator CHAFEE. In that total message of gloom, we will conclude the gathering.

I thank everybody for coming.

[Whereupon, at 12:00 noon, the subcommittee was adjourned, to reconvene at the call of the Chair.]

[Statements submitted for the record and the bill S. 2244 follow:]

STATEMENT OF CONSTANCE B. HARRIMAN, ASSISTANT SECRETARY FOR FISH AND WILDLIFE AND PARKS, DEPARTMENT OF THE INTERIOR, BEFORE THE SENATE ENVIRONMENT AND PUBLIC WORKS COMMITTEE, SUBCOMMITTEE ON ENVIRONMENTAL PROTECTION, CONCERNING S. 2244, THE NONINDIGENOUS AQUATIC NUISANCE ACT OF 1990

June 19, 1990

Mr. Chairman, I appreciate the opportunity to testify on S. 2244, the Nonindigenous Aquatic Nuisance Act of 1990. We support the basic goals and objectives of the bill. However, the bill should be amended to increase its effectiveness without imposing additional bureaucratic requirements. At the same time, the bill should provide for a comprehensive solution to this serious problem.

The recent invasion of the zebra mussel in the Great Lakes is symptomatic of the overriding issues associated with effectively managing the introduction of undesirable aquatic species. The existing authorities, primarily the Lacey Act and Executive Order 11987, are not sufficient to adequately address the full range of issues associated with nonindigenous species. Moreover, efforts to address these issues will require a coordinated approach involving all those who have a vested interest in managing the impacts of undesirable introductions, as well as those affected by any new regulations that may result.

Since European colonization began in the 16th Century, thousands of exotic aquatic organisms have been introduced into North American waters. Some have resulted from intentional actions such as stocking non-native fish, oysters, and aquatic plants, but most have become established as a result of unintentional introductions.

Introductions are still occurring, and if recent experience in the Great Lakes is any indicator, the potential for additional introductions is substantial. Studies of the flora and fauna of ballast water in ships entering the Great Lakes from foreign ports have identified many aquatic species that could become established under the right conditions. For example, a new exotic fish--the tube nosed goby--was discovered at a Detroit power plant less than a month ago.

The Federal Government shares responsibility for introduced organisms with the States. However, that patchwork of programs and policies has proven only marginally effective at managing introductions so as to minimize the risk of adverse impacts.

Existing mechanisms at the Federal level for addressing the problem, include the injurious wildlife provision of the Lacey Act (18 U.S.C. 421, Part 16) and Executive Order 11987. These authorities involve cumbersome regulatory procedures that address introductions on a species by species and case-by-case basis. They have not been employed to deal with unintentional introductions to any extent, and open to question is whether the underlying statutes apply to unplanned introductions.

In addition to its injurious wildlife regulatory responsibilities, the Service is presently involved in a number of other activities related to introduced species. One major area of emphasis is research into the status, distribution, and impacts of exotic fish currently being carried out at the Research Center at Gainsville , Florida. The research capabilities at the Research Centers at Ann Arbor, Michigan and La Crosse, Wisconsin, have been a key element in the Service's central role in cooperative efforts to respond to the explosive dispersal and major impacts of the zebra mussel over the past year and a half.

Experience suggests several factors should be considered when addressing the nonindigenous species problem. Any program should have two major objectives: (1) prevention of undesirable introductions; and (2) control of introduced species populations once established. These objectives should be pursued through cooperative efforts with the States, other Nations, and other interested entities. The introduction of nonindigenous organisms should be approached with a healthy skepticism.

Additionally, any introduced species program should seek an appropriate balance among personal and societal objectives. For intentional introductions, policy should address the challenge of balancing benefits against the risk of adverse impacts. Likewise, the benefits of activities that risk unintentional introduction of undesirable species should be balanced against the potential costs to society. While there is a clear public interest in avoiding and minimizing the adverse impacts of introductions, it should be done without unduly disrupting commerce or intruding into the rights of American citizens.

A final consideration is that introduced species problems are broad, multifaceted, and usually continent-wide in scope. Thus, the full range of Federal resources must be brought to bear in cooperation not only with States and other affected jurisdictions in this country, but also with Canada and Mexico. In some instances, such as introductions associated with shipping, worldwide cooperation may be needed through entities such as the International Maritime Organization.

Strategies for preventing undesirable intentional introductions will be fundamentally different than those appropriate for unintentional introductions. One option for international introductions would be to utilize a "clean list" approach similar to those proposed in the 1970s. Another option would be an "evaluation protocol" approach involving a standard procedure derived from voluntary protocols developed by fishery organizations and scientists since the early 1970s. Because of the opposition encountered by the "clean list" approach when proposed in the 1970s, any program for managing intentional introductions should be based on the "evaluation protocol" approach.

Addressing unplanned introductions requires a completely different strategy. The problem is how to identify activities that have a high risk of resulting in undesirable introductions. Although far less attention has been devoted to this problem, limited research suggests an approach based on the epidemiological model would

probably be appropriate and effective. The model takes into account the victim, vector, and pathogen components of a problem.

Hence, to address the problem of unplanned introductions, a continuing, systematic program is needed to identify potential vectors, determine what organisms are being transported by each vector, and evaluate the risk that each organism will become established and cause substantial, adverse impacts. The key to the success of such an approach is to establish a mechanism to respond to the risks of undesirable introductions identified.

Development of a program to control or manage the impacts of an infestation would be triggered by substantial adverse impacts on natural systems or human activities. Each species or closely related group of species will require a unique, carefully targeted plan. A central concern should be to minimize impacts on non-target organisms. One of the earliest actions should be to monitor the rate and direction of dispersal of the organism and the impacts it is causing. Such information is essential to provide early warning of impacts and to determine whether a full-blown control effort is warranted.

Finally, Mr. Chairman, let me address the bill before us today. S. 2244 provides a useful starting point for developing a comprehensive solution to the introduced species problems facing the Nation, including the zebra mussel. We support the intent of the legislation, but it should be substantially amended to broaden the scope and increase its effectiveness.

The intent of the bill seems to be to focus on prevention of further unintentional introductions, with some aspects of a control program for the zebra mussel. We understand the desire to limit the scope of the bill in the hope of facilitating enactment. However, more comprehensive legislation is needed, including provisions on intentional introductions as well as general authority for control of nonindigenous species.

The ballast water provisions of Title I are fairly comprehensive, but need fine tuning. At the very least, it might be desirable to broaden the scope to cover all methods, in addition to ballast water exchange, by which nonindigenous aquatic organisms might be introduced. In addition, a definition of ships should be included, and criminal penalty provisions should be added.

Several of the major provisions of Title II are far more complex and bureaucratic than necessary. In effect, the title places far too much emphasis on how the U.S. Fish and Wildlife Service and NOAA-Sea Grant are to carry out their responsibilities, and not enough on what must be done. We do not know enough at this stage to say the approach required under S. 2244 will be best in all instances.

While one or a few committees to advise the Secretaries would be desirable, the establishment of 20 or more regional commissions is not warranted. A requirement could be added that appropriate, existing regional bodies be consulted. Section 201(2) could result in a potentially huge new bureaucracy when the purposes would be readily accomplished within the existing organizational

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framework of the Service and NOAA-Sea Grant. To some extent, the regional commissions would duplicate existing regional organizations, such as the Columbia River Fish and Wildlife Authority and the Great Lakes Fishery Commission.

With the massive impacts in the Great Lakes created by zebra mussels, both the Great Lakes Fisheries Commission and the Great Lakes Commission should be directly involved in control of the infestation. However, Canadian and other international interactions regarding introduced species extend far beyond the Great Lakes region. Hence, it would be appropriate to find or establish an organization with responsibilities in this arena as the principal conduit with respect to all other provisions of the bill.

To facilitate management, the responsibilities in subsections 202(a) and (b) should be assigned to both agencies jointly rather than separately. The division of responsibilities would be subsequently worked out under a Memorandum of Agreement similar to that envisioned by subsection 202(c).

The funding authority in the bill should be changed to "such sums as may be necessary." This approach will give the Departments and agencies time to develop a comprehensive program that details our needs more accurately. Recommendations on implementing this program should be developed in the course of the annual budget process.

Regarding designation of zebra mussels as injurious wildlife, the provisions of section 206 would not provide any additional authority and would have no affect on the interstate transport of zebra mussels. If the intent is to control interstate or even intrastate transport, the provision should so state; otherwise, section 206 should be deleted. Lastly, Mr. Chairman, I would like to have the Fish and Wildlife Service continue to work with your committees on additional amendments. Introduced species are a complicated problem involving many broad issues. However, I believe that through cooperative and diligent effort, agreed upon solutions can be found.

Again, Mr. Chairman, thank you for the opportunity to testify on this important issue. I will be pleased to answer any questions you may have.

STATEMENT
OF
GILMAN D. VEITH
DIRECTOR, ENVIRONMENTAL RESEARCH LABORATORY-DULUTH
OFFICE OF RESEARCH AND DEVELOPMENT
U.S. ENVIRONMENTAL PROTECTION AGENCY
BEFORE THE
SUBCOMMITTEE ON ENVIRONMENTAL PROTECTION
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS
UNITED STATES SENATE

JUNE 19, 1990

Mr. Chairman and Members of the Subcommittee:

I am Gilman Veith, Director of the Environmental Research Laboratory-Duluth and of the Great Lakes Research Program of the U.S. Environmental Protection Agency's Office of Research and Development. I appreciate the opportunity to discuss the impacts of nonindigenous aquatic nuisance species on aquatic ecosystems of the coastal and inland waters of the United States.

Over geological time, the isolation of ecosystems allowed the development of biological organizations that were internally balanced. A global diversity was thus established. However, in modern time technology and human activities are increasingly breaking down the natural barriers between ecosystems. It is the nature of ecology that when ecosystems are newly connected, some organisms will dominate thereby eliminating others.

Given the rate of technologic change and movement of people, it is likely that the problems resulting from invasions of non-native species will increase and continue to threaten many of the desired species of existing aquatic ecosystems.

A classic example of this problem is the development of the St. Lawrence Seaway. Through various mechanisms, this connection has been the route for the successful invasion of new species into the Great Lakes.

To deal with this and other problems, the US and Canada have, among other things, established the Great Lakes Water Quality Agreement under which EPA has the responsibility for the development of programs to assess ecosystem health.

As part of the assessment requirement under Annex 11 of the Great Lakes Water Quality Agreement, EPA established the Great Lakes International Surveillance Plan which is used by the Great Lakes Water Quality Board as the model for joint monitoring and surveillance by the US and Canadian governments and the State and Provincial governments.

In response to the 1989 report of the Great Lakes Water Quality Board, which renewed emphasis on the Great Lakes International Surveillance Plan (GLISP) for attaining Great Lakes ecosystem objectives, we are currently assisting the Great Lakes National Program Office in the expansion of annual limnological surveys.

My laboratory in Duluth and its Large Lakes Research Station in Grosse Ile, Michigan, are developing the scientific bases to determine how the Great Lakes will respond to various management options. This research, particularly on toxic chemicals, is highly dependent on understanding the dynamics and mass of energy flow in the Great Lakes food-webs.

EPA has a strong interest in defining these changes in ecosystem dynamics not only to ensure that past investments in assessment technology are protected and updated, but also to insure that future public policies are developed based on the most reliable science we can provide to decision makers.

In this light, EPA has reviewed the provisions of S.2244 entitled the "Nonindigenous Aquatic Nuisance Act of 1990" to prevent and control infestations of coastal and inland waters by the zebra mussel and other nonindigenous species. The findings of Congress in the legislation agree with the data available to EPA.

We look forward to close collaboration on the research and assessment activities with the other interested parties, as we recognize there are immediate economic impacts on our public infrastructure and on our fisheries as well as the long-term impact on health and sustainability of aquatic ecosystems.

In addition to our research work on the Great Lakes, EPA has begun in FY 1990, an environmental monitoring and assessment program, called EMAP, which is designed to take a holistic perspective in monitoring the long-term status and trends of our ecological resources, including estuaries, lakes, streams, and wetlands. One of the primary goals of EMAP will be to provide national policy makers with data with respect to the extent and rate at which specific resources are changing. Determination of biological integrity for our aquatic systems is an important measure of ecosystem health. Depending on the natural variability of the resources being assessed, it may be possible to use EMAP to

assess long-term status and trends of nuisance populations, on a regional or national basis.

EMAP is planned to be expanded to include the Great Lakes systems in FY 1991. In anticipation of this, we are supporting an international workshop this year specifically on the zebra mussel issue in freshwaters. This workshop is intended to provide a public forum for scientific experts from government, universities, and industry to present early results of investigations concerning zebra mussels in the Great Lakes ecosystems. This information will guide the extensive network design activities which are needed for statistically unbiased assessments in the EMAP-Great Lakes effort.

I believe our EMAP and Great Lakes programs can provide statistically defensible measures of the status and trends of populations such as the zebra mussel, as well as a sensitive assessment of ecological impacts in the open waters of the lakes.

As I have described above, EPA already has underway programs which bear on the research goals of S.2244, and which in fact encompass related and broader goals. We would observe that research can most effectively produce results when there are no artificial constraints on the physical location and organizational affiliations of the scientists involved. To the extent that the bill sets up such artificial requirements it is at odds with its own stated purposes. In particular, as we have noted above, EPA as well as the Departments of Commerce and the Interior, is currently conducting research in this area. The funding authorized in the bill should therefore be changed to "such sums as may be

in the bill should therefore be changed to "such sums as may be necessary". This approach will give the departments and agencies involved on this issue, including EPA, time to develop a comprehensive program that details our needs more accurately. Recommendations on implementing this program could then be developed in the course of the annual budget process. We defer to the Departments of Commerce and the Interior concerning other provisions of the bill.

We look forward to working with the other federal agencies on this issue. Mr. Chairman, this concludes my prepared statement.

U.S. Department of Transportation
United States Coast Guard

Commandant
United States Coast Guard

Washington, D.C. 20593-0001
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DEPARTMENT OF TRANSPORTATION

U.S. COAST GUARD

STATEMENT OF CAPTAIN THOMAS E. THOMPSON

ON THE NONINDIGENOUS SPECIES ACT OF 1990

SENATE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

SUBCOMMITTEE ON ENVIRONMENTAL PROTECTION

19 JUNE 1990

DEPARTMENT OF TRANSPORTATION

U.S. COAST GUARD

STATEMENT OF CAPTAIN THOMAS E. THOMPSON

ON THE NONINDIGENOUS AQUATIC NUISANCE ACT OF 1990

UNITED STATES SENATE

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

19 JUNE 1990

GOOD MORNING, MR. CHAIRMAN AND DISTINGUISHED MEMBERS OF THE SUBCOMMITTEE. I AM CAPTAIN TED THOMPSON, CHIEF OF THE PORT SAFETY AND SECURITY DIVISION, OFFICE OF MARINE SAFETY, SECURITY AND ENVIRONMENTAL PROTECTION AT COAST GUARD HEADQUARTERS. THANK YOU FOR THE OPPORTUNITY TO SPEAK TO YOU REGARDING THE NONINDIGENOUS AQUATIC NUISANCE ACT OF 1990 AS WELL AS OUR RECOMMENDATIONS ON HOW TO CONTROL THE INTRODUCTION OF NONINDIGENOUS SPECIES INTO U.S. WATERS. THE U.S. COAST GUARD RECOGNIZES THAT THE INTRODUCTION OF NONINDIGENOUS SPECIES INTO U.S. WATERS IS A PROBLEM THAT NEEDS DEFINITIVE ACTION. THEREFORE, THE U.S. COAST GUARD SUPPORTS, IN CONCEPT, S. 2244.

TO BEGIN, LET ME BRIEFLY DISCUSS THE GLOBAL ASPECTS OF THIS PROBLEM. THERE IS GROWING CONCERN THAT THE INTRODUCTION OF NONINDIGENOUS SPECIES BY SHIPS', PARTICULARLY THROUGH THEIR BALLAST WATER HAS AFFECTED THE ECOSYSTEMS AND ECONOMIES OF COUNTRIES AROUND THE WORLD. IN ORDER TO PREVENT FURTHER NONINDIGENOUS INTRODUCTIONS, TWO COUNTRIES, CANADA AND AUSTRALIA, HAVE INITIATED VOLUNTARY CONTROL PROGRAMS WHICH IMPACT DOMESTIC AND FOREIGN FLAG SHIPS IN INTERNATIONAL TRANSPORT.

IN AUSTRALIA, AS FAR AS WE KNOW, FIVE NONINDIGENOUS AQUATIC SPECIES HAVE BEEN

INTRODUCED IN PORT AREAS: THE JAPANESE SHRIMP, GOBY FISH, MUSSELS, EUROPEAN SHORE CRABS, AND TOXIC DINOFLAGELLATES. THE GREATEST CONCERN IS WITH THE TOXIC DINOFLAGELLATES WHICH CAUSES PARALYTIC SHELLFISH POISONING. A DINOFLAGELLATE IS A TYPE OF ALGAE THAT IS UNICELLULAR AND HAS A WHIP-LIKE FLAGELLA. SOME TYPES OF DINOFLAGELLATE MAY ACCUMULATE IN VERY LARGE NUMBERS AND PRODUCE A "RED TIDE". MANY KINDS OF FISH AND OTHER MARINE ANIMALS ARE OFTEN KILLED DURING THE TIME OF THE "RED TIDE." IN ORDER TO PREVENT A SPREAD TO THEIR POPULATION, THE AUSTRALIAN GOVERNMENT HAS INTRODUCED AN EXPENSIVE HEALTH MONITORING PROGRAM AND HAS CLOSED SOME SHELLFISH FARMS ON OCCASION SINCE 1986.

THE POSSIBILITY OF THE INTRODUCTION OF VIRAL BACTERIAL AND FUNGAL DISEASES INTO AUSTRALIA'S EXPANDING AQUACULTURE PROGRAM THROUGH BALLAST WATER CONTINUES TO BE A GREAT CONCERN. AS A RESULT, THE AUSTRALIAN GOVERNMENT HAS INTRODUCED A VOLUNTARY BALLAST WATER CONTROL PROGRAM. THE EMPHASIS OF THEIR PROGRAM IS TO MINIMIZE THE DISCHARGE OF WATER AND SEDIMENT FROM BALLAST TANKS AND HOLDS USED TO CARRY BALLAST. VESSELS ENTERING AUSTRALIAN PORTS HAVE THREE OPTIONS. FIRST, THE VESSEL CAN PROVIDE A CERTIFICATE VERIFYING THAT THE SHIPS' BALLAST WATER AND SEDIMENT ARE FREE OF TOXIC ORGANISMS; SECOND, THE VESSEL CAN REBALLAST AT SEA OR PERFORM SOME TYPE OF IN-HOLD WATER TREATMENT; THIRD, UPON ARRIVAL INTO PORT, THE VESSEL'S MASTER MAY CERTIFY THAT THE VESSEL WILL NOT DISCHARGE BALLAST WHILE IN PORT. ALTERNATIVELY, THE VESSEL MAY DISCHARGE ITS BALLAST TO AN APPROVED ON-SHORE TREATMENT FACILITY AND/OR DISCHARGE BALLAST TANK SEDIMENT INTO APPROVED DISCHARGE AREAS.

CLOSER TO HOME, RECENTLY, THE ZEBRA MUSSEL HAS BECOME A PROBLEM IN THE GREAT

LAKES. THIS SMALL BIVALVE MOLLUSK WAS FIRST RECOGNIZED AS A PROBLEM IN 1988 AND IS ALSO SUSPECTED OF BEING INTRODUCED THROUGH THE DISCHARGE OF SHIPS' BALLAST WATER. THIS PARTICULAR PROBLEM WAS THE SUBJECT OF THE ANNUAL JOINT CANADIAN COAST GUARD/U.S. COAST GUARD MEETING IN JULY 1988 ON THE "PROGRESS TOWARD ACHIEVING THE OBJECTIVES ESTABLISHED BY THE GREAT LAKES WATER QUALITY AGREEMENT OF 1978." THE CANADIAN GOVERNMENT, IN FULL CONSULTATION WITH THE U.S., THE GREAT LAKES FISHERIES COMMISSION, AND REPRESENTATIVES OF COMMERCIAL SHIPPING, COMPLETED THE DEVELOPMENT OF VOLUNTARY GUIDELINES FOR CONTROLLING THE DISCHARGE OF SHIP BALLAST WATER IN THE GREAT LAKES IN APRIL 1989. UNDER THESE GUIDELINES, THE MASTERS OF SHIPS VISITING ALL GREAT LAKES PORTS ARE REQUESTED TO PROVIDE THE ST. LAWRENCE SEAWAY INSPECTORS WITH A COMPLETED BALLAST WATER EXCHANGE REPORT. THIS REPORT DETAILS WHERE BALLAST WATER WAS TAKEN ABOARD THE VESSEL AND WHETHER OR NOT IT WAS EXCHANGED AT SEA IN ACCORDANCE WITH THE GUIDELINES. IF THE SHIP DID NOT PERFORM AT-SEA BALLAST EXCHANGE, THEN IT WOULD BE REQUESTED TO DO SO NEAR MONTREAL IN THE ST LAWRENCE RIVER. THE CANADIAN COAST GUARD IS IN THE PROCESS OF EVALUATING THE COMPLIANCE RATE AND EFFECTIVENESS OF THE VOLUNTARY GUIDELINES.

IN VIEW OF THE HEALTH AND ECONOMIC IMPACT OF THE INTRODUCTION OF NONINDIGENOUS SPECIES ON THE U.S. AND OTHER COUNTRIES AROUND THE WORLD, THIS MATTER HAS BEEN RAISED AT THE INTERNATIONAL MARITIME ORGANIZATION'S (IMO) MARINE ENVIRONMENT PROTECTION COMMITTEE (MEPC). IMO IS THE UNITED NATIONS' SPECIALIZED AGENCY FOR MARITIME AFFAIRS. IN 1988, MEMBER GOVERNMENTS AS WELL AS NONGOVERNMENTAL ORGANIZATIONS WERE INVITED BY IMO TO SUBMIT RELEVANT INFORMATION REGARDING THIS PROBLEM. THE MOST RECENT MEPC SESSION AT IMO IN MARCH 1990 CONCLUDED THAT THE INTRODUCTION OF NONINDIGENOUS SPECIES IS AN INTERNATIONAL PROBLEM

WHICH REQUIRES AN INTERNATIONAL SOLUTION. THE FOLLOWING COURSE OF ACTION WAS TAKEN; FIRST, THE MEPC AGREED TO FORM A WORKING GROUP AT ITS NEXT MEETING IN NOVEMBER 1990; SECOND, IMO MEMBER STATES AND NONGOVERNMENTAL ORGANIZATIONS HAVE BEEN REQUESTED TO PROVIDE RESEARCH INFORMATION AND PROPOSED SOLUTIONS FOR CONSIDERATION BY THE WORKING GROUP IN DEVELOPING INTERNATIONAL STANDARDS; AND THIRD, PENDING THE INTRODUCTION OF AN INTERNATIONAL APPROACH, MEMBER STATES AND NONGOVERNMENTAL ORGANIZATIONS ARE REQUESTED TO ENCOURAGE SHIP OWNERS AND OPERATORS TO COMPLY WITH CURRENT VOLUNTARY GUIDELINES FOR CONTROL OF BALLAST WATER DISCHARGES. THUS FAR THE ONLY VOLUNTARY GUIDELINES ARE IN AUSTRALIA AND THE GREAT LAKES; CANADA'S GUIDELINES ALSO COVER THE U.S. SIDE OF THE GREAT LAKES.

SEVERAL AREAS OF THE U.S. HAVE BEEN AFFECTED BY THE INTRODUCTION OF NONINDIGENOUS SPECIES BY SHIPS' BALLAST WATER. THE ZEBRA MUSSEL IN THE GREAT LAKES, AND THE ASIAN CLAM IN SAN FRANCISCO BAY HAVE AFFECTED THE ECOLOGICAL BALANCE AND HAVE HAD ECONOMIC IMPACTS IN THOSE AREAS. BECAUSE MOST OF THE VESSELS THAT CALL AT U.S. PORTS ARE FOREIGN FLAG, THE U.S. IS TAKING AN ACTIVE ROLE AT IMO TOWARD THE DEVELOPMENT OF UNIFORM GLOBAL STANDARDS. WE ARE ALSO WORKING WITH CANADA IN FORMULATING A BILATERAL PROGRAM FOR THE GREAT LAKES. THE PROPOSED LEGISLATION CALLS FOR IMPLEMENTATION OF MANDATORY REGULATIONS TO BE IMPLEMENTED FOR EITHER BALLAST WATER EXCHANGE OR AN ALTERNATIVE BALLAST WATER MANAGEMENT METHOD. DUE TO THE NATURE OF THIS PROBLEM, THERE MUST BE A PROGRAM THAT ENCOMPASSES ONE HUNDRED PERCENT OF THOSE VESSELS CAPABLE OF INTRODUCING NONINDIGENOUS SPECIES BY BALLAST WATER.

IN ORDER TO ACHIEVE AN ORDERED, WELL THOUGHT OUT, AND EFFECTIVE PROGRAM, AN

IMPLEMENTATION PROGRAM CONSISTING OF THREE DISTINCT PHASES SHOULD BE CONSIDERED. PHASE ONE WOULD CONSIST OF ESTABLISHING A VOLUNTARY PROGRAM IN THE GREAT LAKES THAT DOVETAILS WITH THE CANADIAN PROGRAM. THIS CAN BE IMPLEMENTED QUICKLY FOR THE FIRST YEAR AFTER PASSAGE OF THE LEGISLATION. SINCE THE GREAT LAKES IS A UNIQUE AREA IN WHICH THE TWO COUNTRIES SHARE JURISDICTIONS, THIS PROGRAM WILL RESULT IN A STANDARDIZED APPROACH AND PREVENT THE IMPRESSION THAT THE U.S. IS TAKING UNILATERAL ACTION ON AN ISSUE THAT AFFECTS BOTH NATIONS. PHASE TWO WOULD CONSIST OF A MANDATORY BALLAST WATER EXCHANGE PROGRAM FOR THE GREAT LAKES DURING THE SECOND YEAR. THE MANDATORY BALLAST WATER EXCHANGE PROGRAM WOULD TAKE INTO CONSIDERATION THE RESULTS OF THE CANADIAN STUDY DURING PHASE ONE. PHASE THREE, DURING THE THIRD AND SUBSEQUENT YEARS, WOULD MANDATE A NATIONWIDE BALLAST WATER EXCHANGE PROGRAM OR PURSUE SOME OTHER ACCEPTABLE ALTERNATIVE THAT ENSURES THAT BALLAST WATER DISCHARGED FROM VESSELS IS FREE FROM NONINDIGENOUS SPECIES. THE INTENT WOULD BE TO EMPLOY PERFORMANCE-ORIENTED, RATHER THAN ENGINEERING-SPECIFIC, CRITERIA. THE PHASE THREE PROGRAM WOULD INCLUDE THE RESULTS OF RESEARCH INTO THE CONTROL OPTIONS AND THE RESULT OF THE INTERNATIONAL STANDARDS.

THE COAST GUARD HAS ALREADY TRANSMITTED TO YOUR STAFF A NUMBER OF ADMINISTRATIVE COMMENTS DIRECTED AT CLARIFYING THE LANGUAGE OF S. 2244. I WOULD LIKE TO NOW ADD SOME ADDITIONAL COMMENTS DIRECTED MORE TOWARD THE CONTENT OF THE LEGISLATION. THE CURRENT PROPOSAL MANDATES THAT THE COAST GUARD IMPLEMENT REGULATIONS NOT LATER THAN SIX MONTHS AFTER THE ENACTMENT OF THIS ACT. THE SIX MONTH TIME PERIOD TO PROMULGATE REGULATIONS IS TOO SHORT, GIVEN THE COMPLEXITY OF THIS ISSUE AND THE EXTENSIVE TIME PERIOD REQUIRED IN THE REGULATORY PROCESS AS A RESULT OF THE ADMINISTRATIVE PROCEDURES ACT.

THE PROPOSED LEGISLATION SHOULD ALSO CONSIDER THE SPREAD OF NONINDIGENOUS SPECIES BY VESSELS THAT TRANSIT FROM ONE U.S. PORT TO ANOTHER. FOR EXAMPLE, VESSELS THAT TRANSIT TO PORTS WITHIN THE GREAT LAKES OR TO OTHER FRESH WATER PORTS AROUND THE U.S. COULD FURTHER SPREAD AN UNWANTED SPECIES.

THE PROPOSED LEGISLATION REQUIRES THAT THE COAST GUARD IMPLEMENT REGULATIONS REQUIRING VESSELS TO CARRY OUT A HIGH SEAS EXCHANGE OF BALLAST WATER OR USE AN ALTERNATIVE BALLAST WATER MANAGEMENT METHOD TO DISCHARGE THEIR BALLAST PRIOR TO ENTERING U.S. WATERS. ALTHOUGH BALLAST WATER EXCHANGE AT PRESENT SEEMS TO BE THE MOST PROMISING ALTERNATIVE, THERE ARE ISSUES WITH REGARD TO SHIP'S SAFETY, ECONOMICS, AND BIOLOGICAL EFFECTIVENESS THAT NEED TO BE ADDRESSED PRIOR TO MAKING A FINAL DETERMINATION.

FIRST, HIGH SEAS EXCHANGE OF BALLAST WHILE THE VESSEL IS UNDERWAY COULD HAVE A NEGATIVE AFFECT ON STABILITY AS A RESULT OF FREE SURFACE AFFECT WHEN A BALLAST TANK IS PARTIALLY FILLED. IN ADDITION, THERE ARE POSSIBLE ADVERSE HULL BENDING STRESSES WHEN A BALLAST TANK IS EMPTIED OR FILLED. ANOTHER SAFETY ISSUE INVOLVES CREW FATIGUE AS A RESULT OF THE EXTRA WORKLOAD. A RELATED ECONOMIC ISSUE HAS TO DO WITH THE IMPACT OF THE WORKLOAD ON VESSEL MANNING REQUIREMENTS.

LASTLY, THE ACTUAL BIOLOGICAL AND ECOLOGICAL EFFECTIVENESS OF BALLAST WATER EXCHANGE MUST ALSO BE DETERMINED. RARELY IS THERE 100 PERCENT EXCHANGE OF WATER WHEN VESSELS DO EXCHANGE BALLAST WATER AT SEA; IT IS POSSIBLE, FOR EXAMPLE, FOR ORIGINAL WATER TO REMAIN AT THE BOTTOM OF BALLAST TANKS AND IN

VARIOUS COMPARTMENTS EVEN AFTER A "COMPLETE" EXCHANGE HAS BEEN MADE. BALLAST TANKS USUALLY CONTAIN SEDIMENTS WHICH CAN BUILD UP OVER SEVERAL BALLASTING OPERATIONS IN PORT, AND WHICH MAY CONTAIN NONINDIGENOUS SPECIES.

THERE APPEAR TO BE MANY VIABLE OPTIONS; HOWEVER, SOME MAY NOT BE REALISTIC FROM A PRACTICAL, EFFECTIVENESS, SAFETY, OR ECONOMIC STANDPOINT. OPTIONS MERITING FURTHER RESEARCH INCLUDE HIGH VELOCITY WATER FLOW, PLACING SCREENS AND FILTERS ON BALLAST PIPING, HEATING BALLAST WATER, TREATING BALLAST WATER WITH A CHEMICAL ADDITIVE, AND USING ULTRAVIOLET LIGHT OR ULTRASOUND AS A TREATMENT METHOD.

THE COAST GUARD HAS FORMED AN INTERAGENCY NONINDIGENOUS SPECIES WORKING GROUP COMPOSED OF THE U.S. FISH AND WILDLIFE SERVICE, THE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, THE ENVIRONMENTAL PROTECTION AGENCY, AND THE NATIONAL MARINE FISHERIES SERVICE. THIS GROUP WILL BE CONDUCTING AN INDEPTH STUDY OF THE ALTERNATIVES TO DETERMINE THEIR ECONOMIC AND PRACTICAL FEASIBILITY. TO ACCOMPLISH THIS TASK, THE WORKING GROUP IS WORKING CLOSELY WITH THE INTERNATIONAL JOINT COMMISSION (CANADA/U.S.), THE GREAT LAKES FISHERIES COMMISSION, INTERESTED ORGANIZATIONS, AND THE INTERNATIONAL MARITIME COMMUNITY TO EVALUATE OPTIONS TO CONTROL THE INFESTATION OF U.S. WATERS BY NONINDIGENOUS SPECIES. A FINAL REPORT WILL BE SUBMITTED TO CONGRESS IN 1991.

THE FUNDING AUTHORIZED IN THE BILL SHOULD BE CHANGED TO "SUCH SUMS AS MAY BE NECESSARY." THIS APPROACH WILL GIVE THE DEPARTMENTS AND AGENCIES TIME TO DEVELOP A COMPREHENSIVE PROGRAM THAT DETAILS OUR NEEDS MORE ACCURATELY. RECOMMENDATIONS ON IMPLEMENTING THIS PROGRAM SHOULD BE DEVELOPED IN THE COURSE

OF THE ANNUAL BUDGET PROCESS.

TO CONCLUDE, THE PHASED PROGRAM I RECOMMEND WILL ALLOW FOR FURTHER RESEARCH AND DEVELOPMENT OF THE BEST AVAILABLE OPTIONS TO CONTROL THE INTRODUCTION OF NONINDIGENOUS SPECIES. BECAUSE THIS IS AN INTERNATIONAL PROBLEM, IT WILL ALLOW FOR THE DEVELOPMENT OF INTERNATIONAL STANDARDS THROUGH THE AUSPICES OF THE INTERNATIONAL MARITIME ORGANIZATION. HASTILY IMPLEMENTING A UNILATERAL PROGRAM BASED ON REACTIONS RATHER THAN A WELL CONSIDERED RESPONSE COULD PROVE TO BE COUNTERPRODUCTIVE. IN THE LONG RUN, A FULLY INTEGRATED INTERNATIONAL STRATEGY WILL BE MOST EFFECTIVE -- ONE THAT INCLUDES COORDINATED STRATEGIES FOR ALL INTRODUCTIONS OF AQUATIC ORGANISMS, INCLUDING THOSE FOR INTENTIONAL RELEASE OR FOR CULTURE, AS WELL AS THOSE INTRODUCED THROUGH SHIPS' BALLAST OR OTHER MEANS.

MR. CHAIRMAN, THIS CONCLUDES MY STATEMENT. I WILL BE GLAD TO ANSWER ANY QUESTIONS THAT YOU OR THE OTHER MEMBERS OF THE SUBCOMMITTEE MIGHT HAVE.

TESTIMONY BEFORE THE SENATE SUBCOMMITTEE ON ENVIRONMENTAL PROTECTION, COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

June 19, 1990

10:30 a.m.
406 Dirksen Bldg.
Washington, D.C.

Statement by:

Dr. Michael J. Donahue
Executive Director

The Great Lakes Commission
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Introduction

I am pleased to be here on behalf of the eight member states of the Great Lakes Commission to speak to problems concerning the infestation of the zebra mussel and other non-indigenous aquatic nuisance species in the Great Lakes and fresh water systems throughout the United States.

We in the Great Lakes Basin - as well as nationally - are presently confronted with a most insidious threat. Its origins and present dimensions are known only imprecisely, and its impacts are, at best, subject to conjecture and speculation. We do know however, that the zebra mussel infestation problem knows no political boundaries; that it may permanently alter ecosystems into which it is introduced; that it has severe economic and environmental consequences; and that prompt, concerted and aggressive attention at all levels of governance is imperative.

In my testimony today, I will address the provisions of S. 2244, the Non-Indigenous Aquatic Nuisance Act of 1990. As requested, I will focus in part on the need to establish a national research, control and educational program directed aquatic nuisance species in waters of the United States. I will also argue that a "partnership approach" between all levels of government, academia and the private sector is not only desirable, but is the single most important element in effective research, monitoring and control programs. Federal legislation is urgently needed to provide a coordinative framework to make that happen. We at the Great Lakes Commission believe that S. 2244 provides such a framework.

The Great Lakes Commission

While each of you are undoubtedly acquainted with the purpose and programs of the Great Lakes Commission, I do wish to begin my testimony with a brief background statement to provide a context for the items that follow.

The Great Lakes Commission is an interstate compact agency with a legislative mandate to represent the collective views of the eight Great Lakes states before Congress and the federal government. The Commission was established in 1955 under state statutes and granted Congressional consent in 1968 via P.L. 90-419, The Great Lakes Basin Compact. The Compact directs the Commission to "promote the orderly, integrated, and comprehensive development, use and conservation of the water resources of the Great Lakes basin."

The role of the Great Lakes Commission in addressing problems related to the infestation of the zebra mussel and other non-indigenous aquatic nuisance species is found in the provisions of the Great Lakes Basin Compact. Article VI empowers the Commission to "Consider means of improving and maintaining the fisheries of the Basin or any portion thereof." Article VII further calls upon the Commission to initiate ".....cooperative action to eradicate destructive and parasitical forces endangering the fisheries, wildlife and other water resources."

The Commission is comprised of governors' appointees, state officials and legislators from its member states (Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania and Wisconsin). It is funded entirely by the states themselves and stands ready to assist and represent them on issues and opportunities of shared interest.

We at the Great Lakes Commission share a resource management philosophy that influences every aspect of our work. To summarize, we recognize that:

- Regional economic development and environmental goals are not mutually exclusive. They are inseparable and must be pursued in concert to achieve the region's full potential.

- The eight Great Lakes states, acting collectively through the Great Lakes Commission, have a principal stewardship responsibility for the precious and irreplaceable resources of the Great Lakes region.

- Management of the Great Lakes is of both national and regional interest; it is neither the exclusive responsibility of the states nor the federal government. Rather, a federal/state partnership must be sustained and nurtured.

- The Great Lakes, despite their vastness and resilience, are a finite and fragile resource. Maintaining their integrity is a sound and necessary investment in the region's economy and environment, as well as the health, welfare and quality of life of its citizens.

The Commission pursues its mandate via three functions: information sharing among its member states, coordination of state positions on regional issues, and advocacy of those positions on which the states agree. A wide range of environmental, resource management and economic development issues are addressed. In so doing, the Commission works closely with governors and state legislators, members of the Great Lakes Congressional Delegation, municipal, state and federal agencies, interstate organizations, private sector firms and associations, universities, colleges and individual citizens.

The Origin and Impacts of Zebra Mussel Introductions in the Great Lakes System

The zebra mussel (Dreissena polymorpha) was first discovered in Lake St. Clair in June 1988, although the age of some harvested specimens suggests that the mussel was introduced in 1985 or 1986. Native to the Black and Caspian Seas, the mussel spread throughout Eastern Europe during the late eighteenth century, aided by the construction of canals for commercial navigation purposes. The zebra mussel had established itself throughout much of the European continent by the 1830s, with colonies being found in Britain as well.

The zebra mussel is believed to have been transported to the Great Lakes Basin via ballast water from a transoceanic vessel. Ballast water taken on in a freshwater European port and subsequently discharged into Lake St. Clair introduced zebra mussel larvae to a new plankton-rich environment well suited to their proliferation. A small, bivalve mollusk with an elongated shell, the zebra mussel grows up to two inches in length, with an expected lifespan of five years. The adult mussel feeds on plankton by filtering water at a rate of one liter per day. The adult female can produce over 30,000 eggs per season, which can range as long as May through October in parts of the Great Lakes Basin.

In their free-swimming larval (or "veliger') stage, zebra mussels are scattered by currents over a wide area. As adults, they become stationary, anchoring to any hard, non-toxic substrate with a tuft of fibers known as byssal threads. In this stage, they can colonize in great density; beds of mussels in portions of Lake Erie contain up to 70,000 zebra mussels per square meter.

Although they prefer warm temperatures, shallow water, slow currents, and a plankton-rich environment, the zebra mussel has demonstrated a tolerance for waters throughout the Great Lakes Basin. Although Lake Erie remains the locus of the bulk of the infestations, reports of zebra mussel colonies have in recent years come from many parts of the Basin, include Lake Superior. The entire Great Lakes System and its tributaries are believed to be vulnerable to large scale infestations, as is a substantial portion of the United States.

The ecosystemic and economic impacts of the zebra mussel are pervasive. Experts attending a March 1990 workshop sponsored by the Great Lakes Fishery Commission and the International Joint Commission agreed that "Exotic aquatic organisms have the potential to transform water quality, existing plant and animal communities, and human use of the aquatic ecosystem that they invade." The potential impact on the fishery is profound. For example, the zebra mussel colonizes the rock substrate used for spawning by the walleye; a principal sport fish. The filtering capacity of the zebra mussel efficiently eliminates plankton from the water column, binding it into "pseudofeces" that are ejected from the mussels' syphons and accumulate among the shells in the colony, thereby creating an adverse spawning environment.

Canadian researchers have determined that a uniform density of 7,000 zebra mussels per square meter in the western basin of Lake Erie could filter the entire water volume of the western basin in a twenty-four hour period. Beyond its impact on the food chain and the sport fishery, other potential concerns exist. Like other freshwater mollusks, for example, zebra mussels can also serve as "intermediate hosts" for a variety of parasites that can infect fish, wildlife and potentially humans.

Economic impacts of the zebra mussel infestation are as pervasive as the ecosystemic impacts. The zebra mussel is not selective about substrates; it attaches itself to boat hulls; reefs; navigational buoys; anchors; and water intakes, to name a few. The municipal water intake in Monroe, Michigan, for example, experienced a temporary interruption of flow in December 1989, due to large concentrations of zebra mussels obstructing the intake. Emergency sources of water supply were activated until the flow could be resumed. Variations on this scenario have been seen with increasing regularity over the last twelve months at municipal water intakes, power plants and private manufacturing operations.

Commercial and recreational vessels are also vulnerable to damage or compromised fuel efficiency. Once attached to the hull of a vessel, zebra mussel colonies will create drag, lessen fuel efficiency and (on small boats), place an unnecessary strain on motors. Zebra mussels drawn into an engines's cooling water intake can occlude the system, leading to overheating and engine damage. Navigational buoys can sink under the weight of zebra mussel colonies, as has been observed. Colonies on dock pilings and ladders can interfere with dockage and expedite corrosion. With respect to recreation, beach areas littered by zebra mussel shells and the odors of decaying zebra mussels have been observed, with an attendant impact upon usage levels.

One respected Great Lakes scientist has been quoted as saying that the environmental and economic impacts over the long term could exceed those associated with the *Exxon Valdez* disaster. If the infestation is left unchecked, damages in excess of four billion dollars over the next ten years have been estimated; this is approximately the annual economic value of the entire Great Lakes sport fishing industry. Costs associated with the cleaning of municipal and industrial water intakes, the locks at the Welland Canal and other structures have already run into tens of millions of dollars.

A variety of control mechanisms have been identified but a viable means to effectively manage or eradicate the zebra mussel population on a Great Lakes - wide basis has yet to be found. Protection of water intakes is possible (to varying degrees of effectiveness) through physical and mechanical controls. These include, for example, a traveling screen mesh; micro-straining fabrics; physical scraping; electrical currents; electrostatic filters and outright replacement of occluded intakes.

Other control options oriented at preventing colonization include: ballast water controls (as noted earlier); oxygen deprivation at intakes; thermal control (flushing with heated water); chemical application (including chlorination); anti-fouling coatings; and molluscicides. To date, most attention has been focused at site-specific control; a focus on Basin-wide control options is needed.

The environmental and economic implications of the zebra mussel infestation problem speak to the magnitude and immediacy of the issue. While this is indeed a matter of national significance, it is clear that effective control strategies within the Great Lakes Basin will have a preventive value for other regions far removed from ours.

Despite the magnitude of the task at hand, the Great Lakes region is fortunate to have in place an elaborate binational network of agencies, organizations and research institutes that can be mobilized to address the zebra mussel infestation problem and more generally, the introduction of exotic species. Experiences gained through the region's decades-old battle with the sea lamprey - another non-indigenous aquatic nuisance - are valuable ones.

The Great Lakes Commission notes that crisis-response measures for research, monitoring and control are already in place - to varying modest degrees - at the local, state, provincial and federal levels. Task forces and less formal networks have been established in many jurisdictions, and countless hearings, conferences and workshops - at all levels - have helped educate, inform and coordinate site-specific responses.

Although such efforts are laudable, we believe they are inadequate. They are piecemeal, poorly coordinated and directed almost exclusively at crises rather than long-term control options. A tremendous amount of expertise is available in the region, but we have yet to see any indication of a single, coordinated and unified strategy that blends research, monitoring and control activities, applies them on a Basin-wide level, and utilizes the individual and collective expertise of all relevant disciplines and public-private sector resources. While such a strategy would appear to be of monumental dimensions, we need only remind ourselves that we are also addressing a problem of monumental dimensions.

We at the Great Lakes Commission are concerned that zebra mussel control efforts, as presently evolving, may have little long term Basin-wide impact. The problem isn't just a biological one - it's an institutional one as well. We believe an immediate need exists for federal leadership in the form of a federal law that establishes a strong, action-oriented, coordinative framework with a primary focus on the development and application of control strategies.

Commission Perspective on Federal Legislation

The Great Lakes Commission supports the intent of S.2244, the Non-Indigenous Aquatic Nuisance Act of 1990. The bill establishes an aggressive program that provides a framework for multi-jurisdictional coordination and an appropriate balance between research, monitoring and control efforts. It also provides a means to anticipate and

address any prospective impacts of other exotic species; an opportunity to escape from the "crisis-response" model that has characterized this issue thus far.

We note several strengths in the legislation that should guide any and all legislative, program and policy initiatives to control non-indigenous aquatic nuisance species.

1) While the zebra mussel infestation problem is highlighted, the legislation does have a broader focus. The zebra mussel is but one of over 60 exotic species whose presence in the waters of the Great Lakes has been documented. The European percid ruffe (Gymnocephalus cernus) and spiny water flea (Bythotrephes cederstroemi) - to name just two - can potentially disrupt the Great Lakes ecosystem as well. A focus on the zebra mussel alone would do little to anticipate and prevent future harmful introductions.

2) This is not just a Great Lakes issue; its a national issue and must be approached as such. A special emphasis on the Great Lakes is appropriate, however, given the fact our success in controlling an existing problem can directly aid preventive efforts elsewhere.

3) As noted earlier, the challenge we face has both a biological and institutional dimension. With regard to the latter, the coordinative framework provided for in the legislation should help ensure a multi-jurisdictional and multi-disciplinary approach to the control effort. With some exceptions (identified later) the legislation appears to involve the "principal players" and a mechanism to focus their individual and collective expertise.

4) The emphasis on "environmentally sound" control options is a very appropriate one. Ill-conceived "quick fix" solutions - chemical or otherwise - may very well create new problems while addressing existing ones.

5) The legislation offers an effective approach to ballast water exchange requirements, but provides the flexibility needed to ensure ship safety and the use of other treatment methods determined to be equally effective and environmentally sound.

6) Finally, public information and education is unquestionably a key component in efforts to control or prevent the transport of the zebra mussel and other exotic species to uninfested areas. Concerns relating to transport by boat trailer or in engine cooling systems are legitimate ones and demand a concerted public information and education program.

The Commission is emphatic in its support for the intent of S. 2244. Time is of the essence and broad-based Congressional support is needed. In this spirit, we offer several comments and suggests that, in our opinion, will strengthen its language and enhance the effectiveness of subsequent programs.

1) While the elaborate coordinative structure established by the bill is critical, coordination alone will not solve the problem; the actual application of control programs will. Every effort must be made to ensure that the coordinative structure is an efficient and effective means to a more important end - the control or eradication of the zebra mussel and other non-indigenous exotic nuisance species.

2) The proposed "National Cooperative Action Group" to oversee national and regional research, control and education programs is a sound approach. We recommend, however, that the presence and stature of the U.S. Environmental Protection Agency

be increased, in recognition of the important role that agency can play in all aspects of the program. A similar suggestion relates to the U.S. Army Corps of Engineers. We believe the Corps can offer substantial expertise, particularly as it relates to protection of public infrastructure. We at the Commission fully support the Corps' proposed Great Lakes Environmental Action Plan (Great LEAP) and view this as an opportunity to focus Corps capabilities on a pressing problem. Appropriate revision to the "lead agencies" section of the bill is recommended.

3) Additional flexibility in the composition of the regional commissions is advisable. For example, commercial shipping and port interests should have access to this forum. Further, provisions for "at-large" membership should be made to ensure participation by individuals with special expertise. While uniformity among the regional commissions is desired, accommodation of needs specific to individual regions should be made where necessary.

4) The role of the regional commissions should go beyond priority setting, advising, coordinating and report writing, as provided in the legislation. The commissions should be a vehicle to select and implement control programs. Again, time is of the essence, and elaborate coordinative structures will do little if not accompanied by an aggressive control program.

5) The Great Lakes Commission recognizes the important role its member states can and should play in this issue. The regional commission is one effective means to encourage this. However, some form of technical assistance - including grants to the states - would provide the resources and incentives needed to make full and effective state participation possible in all aspects of the research, control and educational program. Some consideration should be given to this under the section authorizing appropriations. Also, consideration should be given to making states eligible for competitive research grants.

6) We believe that a new and separate regional commission in the Great Lakes region is not necessary to accomplish the goals of the legislation. Rather, the Great Lakes Commission - as a membership organization of the Great Lakes states and cooperating federal agencies and provinces - already provides a viable, time-tested and effective mechanism. We therefore suggest that the Great Lakes Commission be designated as the regional commission, pursuant to provisions in the legislation. This will reduce concerns about the "bureaucratization" of the control effort and provide immediate access to an existing institution. The Great Lakes Commission is fully supportive of the control efforts outlined in S. 2244 and is willing to consider such designation. Given adequate funding, we believe we can work with the Great Lakes Fishery Commission and other interests to provide a valuable coordinative service to our member states, the region and the nation.

7) The section providing for "interactions with foreign countries" addresses an important need, but does not go far enough with respect to the binational Great Lakes Basin. Canadian federal and provincial representation on the regional committee in the Great Lakes is imperative, whether it be in a membership or observer role. We note that U.S.-Canadian cooperation and interaction on this issue has generally been inadequate. This legislation can address that concern.

Closing Statement

The zebra mussel/exotics issue has prompted a flurry of legislative, program and policy activity within and among Great Lakes jurisdictions, agencies and the Great Lakes

Congressional Delegation. We at the Great Lakes Commission believe that this level of activity should be a catalyst - and not an impediment - for progress. The notion of a "Great Lakes partnership" among the region's elected officials, agencies and user groups has been the focus of much rhetoric in recent years. The zebra mussel/exotics issue provides an opportunity to act on that rhetoric - to forge a single overall strategy and an alliance through which all parties can direct their respective expertise.

Federal leadership is needed to make the "partnership approach" work, and federal legislation is the starting point. We believe S. 2244 provides an excellent framework for this purpose. In final form, it should address the several suggestions and concerns raised by the Great Lakes Commission. We stand ready to assist you in any way possible.

STATEMENT
OF
ALFRED M. BEETON
DIRECTOR, GREAT LAKES ENVIRONMENTAL RESEARCH LABORATORY
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

BEFORE THE

SUBCOMMITTEE ON ENVIRONMENTAL PROTECTION
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

UNITED STATES SENATE

JUNE 19, 1990

Mr. Chairman and Members of the Subcommittee:

I am Alfred Beeton, Director of the Great Lakes Environmental Research Laboratory (GLERL) of the National Oceanic and Atmospheric Administration (NOAA), U.S. Department of Commerce. I appreciate the opportunity to testify on **S. 2244**, the Non-Indigenous Aquatic Nuisance Act, and to discuss the present and possible future impact of the zebra mussel and other exotic species on the Great Lakes and other aquatic environments. While we support the intent of S. 2244, the funding levels should be changed to "such sums as may be necessary," in order to give the agencies an opportunity to develop a comprehensive program and to determine needs based on the programs we develop.

BACKGROUND

Exotic species are not new to the Great Lakes ecosystem. Man's activities have introduced many species of plants and animals over the past 100-plus years, both planned and

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accidentally. Some introduced species have been considered beneficial, e.g., brown trout, rainbow trout, and several kinds of salmon, although we have little understanding of the effects they had on the native biota. Some species, such as the Chinese mitten crab (Eriocheir sinensis), Asiatic clam (Corbicula fluminea), European flounder (Platichthys flessus), and macroalgae (Nitellopsis), have not attained great abundances nor have they become widely distributed. Exotic species continue to gain access to the Great Lakes. Just this spring a fish, the tube-nosed goby, Proterorhinus marmoratus, which lives in the Black Sea, was captured in the Detroit River.

Unfortunately, several exotic species have adversely affected important habitats and associated biota. The sea lamprey had catastrophic consequences for native species of coregonid herring-type fishes and the lake trout. It has resulted in damages and losses to commercial fisheries at the tens of millions of dollars level, and brought about the implementation in the late 1950's of a costly and continuing eradication/control program. In the late 1960's, the build-up of huge alewife populations accelerated the collapse of coregonid populations, adversely affected yellow perch and other native species, and caused economic hardships for communities across the region by necessitating costly clean-ups of hundreds of millions of dead alewife littering the beaches every year. Subsequently, the alewife became an important prey fish for introduced salmon, and the system has come to a fragile balance.

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Recently three new organisms have established populations in the Great Lakes: the zebra mussel (Dreissena polymorpha), a small bivalve; Bythotrephes cederstroemi, a large zooplankter (a cladoceran, also called the "fresh water flea"); and the river ruffe (Gymnocephalus cernuum), a medium-sized fish related to the perch. Two of these new invaders are undergoing rapid population explosions and are expected to become widespread and dramatically alter existing trophic relationships in the ecosystem, not only in the Great Lakes, but potentially across large sections of the United States.

The Zebra Mussel

The zebra mussel, Dreissena polymorpha, is a small filter-feeding bivalve that attaches to any firm substrate. Historically this mussel had been found exclusively in the Black and Caspian Seas, but with increasing water transport and trade, it quickly spread into Europe in the early 1800's. It has continued to spread across Europe, and its presence continues to have economic impact there. Dreissena was first discovered in North America in Lake St. Clair in late spring 1988 and by fall 1989 had spread throughout Lake Erie and into Lake Ontario. This organism is a prolific breeder and is capable of increasing in numbers very rapidly. A mature female is capable of releasing up to 40,000 eggs during the reproductive season (water temperature >12°C). The eggs are fertilized in the water and develop into planktonic larvae (veligers), which are transported by currents,

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thus enhancing dispersal. Within a few weeks the veligers must attach to a hard surface, such as a water intake pipe or boat hull, to continue developing, and the organisms remain there through the adult stage. The zebra mussel has a life span of 3-5 years, and reaches a maximum size of about 4 cm.

Additional larvae attach themselves on top of previous organisms, creating layer upon layer of shell and byssal thread masses that have been shown capable of reducing the opening of an intake pipe from three feet in diameter to less than one foot, thus impacting pumping requirements and resulting water flow. For instance, in the summer of 1988 densities of 200 m^{-2} were reported in the intake canal of a power plant in western Lake Erie. By the summer of 1989, densities had increased to over 500,000 per square meter. In Monroe, MI, the city water intake pipe suffered flow reduction of 45-55% from the early spring to the end of summer, 1989, due to zebra mussel infestation. In December 1989, a combination of zebra mussels and frazil ice build-up shut down the water intake completely for over a day, forcing the city to implement emergency water restrictions and jury-rig a temporary new water supply. The City of Monroe will install a secondary intake this summer at a cost of $500,000 with feed lines for chlorine and ozone treatment of the mussels.

Some 20 Ontario towns which draw water from Lake Erie have reported problems with zebra mussels attaching inside of intake pipes. Beaches are being littered with millions of zebra mussel

shells. The mussels are encrusting boat hulls and clogging cooling water intakes thereby damaging boating. In the fall of 1989, walleye spawning reefs of western Lake Erie were covered with zebra mussels which may threaten the survival of the walleye eggs. Apparently the zebra mussel's ability to filter large quantities of water, thus removing certain small organisms of the food web, has led to a two-fold increase in water clarity. Such filtering capacity will likely influence, and possibly significantly change, the distribution and cycling of toxic contaminants, and alter the productivity of the affected water bodies.

The zebra mussel has spread very rapidly since it was first discovered in Lake St. Clair in the spring of 1988. Last year it became established in Lake Erie, western Lake Ontario and the St. Lawrence River. Within the past several weeks its presence in the Saginaw River of Lake Huron and Duluth Harbor, Lake Superior has been verified. Thus it is now in all the Great Lakes except perhaps Lake Michigan.

The zebra mussel will have major, and perhaps catastrophic economic impact wherever it spreads, because it is a prolific fouling organism. Corrective measures over the next decade could cost more than any previous exotic in the history of the United States as power plants, municipalities, factories, pleasure boat owners, and commercial vessel operators attempt to deal with clogged intake pipes, fouled hulls, and engine cooling lines.

6

Because the zebra mussel is a prodigious filter feeder, it has the potential to alter the structure of the lower food web, and could exert strong influence on water quality by affecting the distribution and cycling of toxics, nutrients, and other pollutants. Furthermore, it may seriously alter the physical structure of major spawning reefs and thus, their function as critical habitats.

Bythotrephes

Bythotrephes is a large zooplankter, a cladoceran, also known as the water flea. It was first reported in Lake Huron in 1984 and by 1989 had become a dominant member of the plankton community in all of the Great Lakes. Little is known about this species - even in Europe - because of difficulties in studying the organism and because of the lack of understanding of its role in shaping community structure. Widespread throughout Europe, it is a native species there, and its ecological effects when introduced into an existing, balanced ecosystem, are undocumented and thus, unknown.

Work performed at GLERL suggests that Bythotrephes is a voracious selective predator. Recent shifts in zooplankton community structure of the Great Lakes have been hypothesized to be caused by Bythotrephes. This species may also affect the recruitment of a variety of important forage and sport fishes such as bloaters, alewife, perch, and Chinook salmon by

out-competing the juveniles of these species for their normal prey. Most of the concern has focused on the fact that Bythotrephes is not found in the guts of many small fishes, implying that it is not eaten, and also that Bythotrephes is clearly a new competitor for food, consuming other zooplankton that are the favored prey of the juveniles of many fish species. Many smaller fishes appear unable to consume Bythotrephes because of its long tail spine.

The probable ecological impact of Bythotrephes is less clear, but it is a primary suspect in an already-observed shift in one part of the basic zooplankton assemblage in the Great Lakes, and there is concern that within the lower food web it may seriously alter predator-prey relationships which will translate to loss of fisheries recruitment in important forage and sports fishes.

NATIONAL SIGNIFICANCE

As noted, the zebra mussel and Bythotrephes have already spread into half or more of the Great Lakes. Because the Great Lakes are directly and indirectly connected to major tributaries (for example, the Hudson River via the Erie Canal; the Mississippi River via the Chicago diversion), it is expected that these organisms can and will ultimately spread into freshwater lakes, rivers, and streams throughout a large section of the United States. In addition, mussels attached to the hulls of pleasure boats that are trailered from one body of water to

another can survive out of water for up to 14 days. This is more than enough time for a boat from Lake Erie to be moved and placed in lakes, rivers, or streams anywhere in the United States. Since it does not proliferate in waters that are either too warm or too cold, the problem will likely be restricted to major temperate sections of the United States (about 60% of the U.S.) and southern Canada.

Likewise, Bythotrephes, like other cladocera, forms resting eggs that often wind up in lake bottom sediment, attached to fish nets, or in bilges. Their eggs can withstand some degree of drying and freezing, and could be transported to other lakes in the mud attached to birds' feet or boat hulls and propellers, attached to fishing nets, and in the bilges of small boats. Because of these transport mechanisms, which have been documented for cladocera in general, it is typical for them to be found in lakes over wide geographical areas. Bythotrephes thus has the potential to spread to any north temperate lake.

CURRENT UNKNOWNS

There currently exists a lack of information and understanding about the spread, life habits, physiology, and ecological and environmental significance of exotic species in the Great Lakes, especially the zebra mussel and the zooplankter, Bythotrephes. We also lack an understanding of these organisms' interactions with and impact on the cycling, bioaccumulation and biotransfer of toxics contaminants and other pollutants. Such

information would form the basis for providing assistance and information to resource managers in the Great Lakes and other areas who will have to deal with the economic and environmental impacts of these organisms as they spread and would provide the basic information needed to develop control strategies, especially those which will be ecologically sound.

Our Great Lakes Environmental Research Laboratory has started research on the distribution and ecological impact of the zebra mussel. Some research has been underway on the ecology and feeding behavior and the acceptability of Bythotrephes as a food item for fishes. The National Sea Grant Program too is involved in research efforts on the zebra mussel in its Sea Grant Colleges in Ohio, Wisconsin, and Michigan.

NOAA has also assisted in coordinating research and advisory services. Two meetings have been held recently with representatives from GLERL, Sea Grant, USFWS, and the Great Lakes Commissioners. The most recent meeting was held June 6. It is desirable for programs focused on exotic species to have very close collaboration and participation by NOAA, EPA, USFWS, Coast Guard, state agencies, and academic institutions in the region. To facilitate this operation, the U.S. Coast Guard established an interagency non-indigenous species working group composed of the USFWS, NOAA, EPA and the U.S. Coast Guard. Close cooperation

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with our counterpart Canadian institutions is essential. It is highly desirable to interact with visiting scientists from Europe who have expertise and experience with these organisms in Europe.

This concludes my prepared statement and I would be pleased to respond to questions.

Statement by Dr. James T. Carlton
on the
"Nonindigenous Aquatic Nuisance Act of 1990" (S. 2244)
Washington, D.C. June 19 1990

Mr. Chairman and members of the Committee: Good afternoon and thank you for the opportunity to address these issues.

My name is James Carlton. I am a marine ecologist and biogeographer, Associate Professor of Marine Sciences at Williams College, and Director of the Williams College - Mystic Seaport Maritime Studies Program. My research interests since 1962 have focused on the biology, ecology, history and mechanisms of dispersal of non-indigenous species of marine, estuarine, and fresh water animals and plants. Non-indigenous species (also known as introduced, non-native, exotic, or alien species) are now often referred to as "biological invasions."

I am the head of a laboratory, funded by Sea Grant, that focuses on ballast water as a dispersal mechanism for living aquatic organisms. This lab is at the University of Oregon's Institute of Marine Biology. I am also co-principal investigator, along with Dr. Gary Sprules of the University of Toronto, of a new ballast water study funded to date by the Canadian Coast Guard. This study is located on the St. Lawrence Seaway near Montreal. I began studying ballast water under National Science Foundation funding at the Woods Hole Oceanographic Institution in 1980.

There are numerous mechanisms by which nonindigenous aquatic organisms are now invading North America. On any one day, through the aquaculture-mariculture industries, the aquarium-hobby trade, drilling platforms, scientific research, the bottoms of ships, and in ballast water in ships, it is probable that several hundred species of exotic animals and plants are inbound to the United States, with the potential for the release of most of these in open waters. Of these transport mechanisms, we now hold ballast water to be one of the most important means by which living marine and freshwater organisms are now being quickly spread around an increasingly homogenized world.

Ballast water is not bilge water. Ballast water is the river, harbor, bay, coastal or ocean water adjacent to a vessel, containing whatever living organisms may happen to be there at the moment of ballasting. This water is taken up by a vessel instead of or in addition to cargo. The hourly, daily, seasonal, and annual changes in the biotic composition of a body of water mean that the same foreign river or port can provide a constantly changing menu of species that can be taken up by a vessel. Two vessels ballasting up in the same northern European port at noon and at midnight of the same day can thus depart for the Great Lakes, or Long Island Sound, or Chesapeake Bay, with two strikingly different sets of species. There is thus a good deal of randomness in what kinds of organisms are pumped into a ship at any one time from any one place. What kinds of species are likely to invade thus depends upon what kinds of species happen to be ballasted up.

In turn, the receiving environments are constantly changing in biological and chemical composition in a manner as complex, and as fascinating, as the patterns rendered by a twisting kaleidoscope passing over a wide range of light. Thirteen to fifteen days after being ballasted up in Europe the melange of ballast water organisms is released into a new environment in

North America, instantly intermixing with that environment at a particular moment of time.

Most of these organisms do not survive. Some, like the zebra mussel, step onto the biological escalator at precisely the right moment, and ascend quickly to astronomical levels. We generally do not know why the zebra mussel, or most other accidental introductions, are successful when (or where) they are. The probability is high that the larvae (the microscopic planktonic stages) of the zebra mussel were released in the Great Lakes by ballast water between the 1960s and 1980s, but why such previous inoculations, if such occurred, were not successful, and an inoculation in the mid-1980s was successful, is not yet known.

The nature of the donor and receiving environments are but two variables mediating successful biological invasions -- the mechanism of dispersal is not static either. Vessels vary in the amount of the water they carry, and how fast they carry it. Amounts carried and ship speed have increased considerably since ballast water became a regular part of maritime commerce in the 1880s. In the 1980s ballast water became one of the most effective mechanisms for the intercontinental, transoceanic transport of aquatic organisms. Perhaps it was because the volume of water carried combined with the higher speeds of ocean-going vessels broke through a biological barrier that had previously kept ballast-related invasions to a lower level. Or perhaps other phenomena are at play that we do not yet fully understand.

Whatever the reasons, we are now witnessing numerous invasions around the world by aquatic animals and plants. These introductions range from the spectacular to the innocuous, although the latter, given time, may achieve the former's status.

In the 1980s the following happened:

Red-tide causing dinoflagellates from Japan appeared in southern Australia, as did Asian species of fish, mussels, and worms. Japanese copepods (small planktonic crustaceans) were recorded from Chilean fjords. A small clam native to China and Japan appeared in San Francisco Bay, and it is now one of the most abundant bottom-dwelling animals in that estuary. A specimen of a Western Pacific crab, an egg-bearing female, was collected in the Western Atlantic, in New Jersey. Red tides and brown tides, often caused by planktonic organisms not known in these regions, have become more common in ports, harbors and sounds of the Atlantic and Gulf coasts.

Norway reported spectacular occurrences of planktonic organisms that discolor the water. One of our common Atlantic comb jellies, a two-inch long gelatinous oval organism, appeared in the Black Sea, and Russian scientists reported in 1990 that many millions of tons of these organisms have now blossomed there.

And freshwater organisms from Europe have done very well in the Great Lakes. At least three species, the ruffe, the spiny water flea, and the zebra mussel, are now well established, but certainly more ballast-introduced species are in the Great Lakes that we have not yet discovered. (The zebra mussel arrived in the Great Lakes in 1985-1986; it was discovered in the summer of 1988. This means that a new organism inoculated in the Great Lakes in 1989 may not reach detectable levels until 1991 or 1992.)

The vast range of donor and receiving environments listed above suggests that the 1980s success of these non-indigenous animals and plants must be related to the one common thread that appears to link all of these species -- transport by ballast water.

Inoculations and invasions continue. In our studies at the Oregon Institute of Marine Biology we found over 300 species of living animals and plants in the first 100 vessels that we sampled coming from Japan. Our Australian colleagues have recorded numerous living marine animals and plants in ballast water and sediments. Our Canadian laboratory focuses on the ballast water now entering the Great Lakes from Europe and elsewhere. In particular, we are looking at compliance with the Canadian Coast Guard's ballast exchange guidelines and the effectiveness of high seas exchange. Our field laboratory personnel began boarding ships just 15 days ago, and so we have no results to report to you as yet.

In theory, however, open-ocean exchange of ballast water should significantly reduce the potential of freshwater organisms further invading the Great Lakes, and it should lead to an important reduction of the potential of exotic coastal organisms to invade our coasts. Organisms from the middle of the ocean are few in species and in numbers as compared to coastal and freshwater ecosystems. Most are also unique to the high seas; as far as we know, they generally do not and cannot live in coastal waters. The potential for long-term survival of these high seas organisms in our coastal zones is extremely low when compared to the very high potential survival of organisms originating from foreign coastal zones and rivers.

The fact that we have had ballast water released from many countries into United States waters for many decades, often transported from and to the same ports, combined with the fact that new introductions continue to occur, indicates that the argument, in reference to exotic species, "if it was going to be here, it would be here by now: is probably not true for many organisms. As we do not yet understand those processes that regulate invasions, it makes sense to regulate those processes that facilitate the initial transport of the invaders.

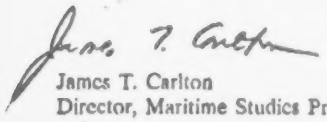
As with all countries, it appears we can do little but hope relative to those organisms that are on the bottoms of ocean-going vessels. But the spigot could be cranked down for those organisms that are inside ocean-going vessels in ballast water. While it may not be possible in the twentieth century to turn that spigot off entirely, ameliorative measures, including open-ocean exchange, will go a very long way in removing from these biological conveyor belts many potential invaders.

The need for the control of ballast water releases will come to the attention of many other countries in this decade, perhaps in most instances only after a major invasion of a particularly disastrous exotic animal or plant has occurred. But in the United States, passage of H.R. 4214 means that we could significantly dampen the further invasion of our coasts and the Great Lakes before the next spectacular introduction occurs. This action will help further protect coastal zone environments which we strive to protect through other means. We have for example in place a superb and growing system of National Estuarine Research Reserves, set aside in part to preserve pieces of the aboriginal aquatic environments of this country. These reserves are prime sites for continued invasions by exotic species.

Coupled with this, of course, is the critical need to know about the ecological and economic impact of exotic (aquatic nuisance) species in U.S. waters, to mount research efforts aimed at controlling these species, and to educate the public about what is being done, and what can be done, to minimize the impact and spread of these non-indigenous organisms. These efforts are for the most part now widely scattered and poorly funded among hundreds of different agencies and departments. A focused national program would save many years and many millions of dollars, by establishing centers of research excellence and by avoiding repetition and duplication in educational efforts.

I recommend that Congress approve the Nonindigenous Aquatic Nuisance Act of 1990. It is an important step for the United States.

Thank you.



James T. Carlton
Director, Maritime Studies Program
and
Associate Professor of Marine Sciences
Williams College - Mystic Seaport
Mystic, Connecticut 06355

TESTIMONY OF

J.D. SNYDER, DIRECTOR

OFFICE OF THE GREAT LAKES

MICHIGAN DEPARTMENT OF NATURAL RESOURCES

BEFORE THE U.S. SENATE SUBCOMMITTEE ON

ENVIRONMENTAL PROTECTION

HEARING HELD ON

JUNE 19, 1990

Introduction

Thank you for this opportunity to comment on "The Nonindigenous Aquatic Nuisance Act of 1990," (H.R. 4214 and S. 2244). I commend the subcommittee and the Chair for your attention to this critical problem affecting the Great Lakes.

Michigan strongly supports H.R. 4214/S. 2244, and urges that swift action on these bills be taken so that introductions of additional nonindigenous species through transoceanic ballast discharge can be prevented, and to provide funds for monitoring and research to advance the development of management and control techniques for aquatic nuisance species.

Michigan's Experience and Concerns

Michigan has already experienced adverse social and economic impacts from zebra mussels. The City of Monroe in Southeast Michigan experienced blocked municipal water intake pipes in December of 1989, and has planned expenditures of over $500,000 to build a new water intake pipe to avoid a similar experience in the future. Detroit has recently discovered zebra mussels in its water intake which serves nearly 2 million people, and must increase its annual operating costs by $100,000 annually to incorporate zebra mussel control measures.

Other facilities such as the Ford Rouge Steel plant and the City of Alpena are reviewing control measures and will likely incur similar costs. Costs to the Great Lakes Basin residents will approach $4 billion over the next 10 years, according to the U.S. Fish and Wildlife Service. Given Michigan's central location in the Great Lakes, a significant portion of those costs will likely be borne by Michigan citizens.

Our experience with the sea lamprey exemplifies the costs associated with exotic species in the Great Lakes ecosystem. After many years and millions of dollars for research and control, the sea lamprey is held in check-but only with continued control measure funding amounting to $9.6 million this year.

Fouled beaches and sunken navigation buoys from the weight of layers upon layers of zebra mussels can be expected. Our 800,000 registered boaters, as well as shipping interests, are vulnerable to the mussels' impacts, ranging from compromised fuel efficiency due to mussel colonization of vessel hulls, to irreparable motor damage caused by clogged cooling water intakes.

The impacts from this unwanted invader are not limited to social and economic consequences. Our approximately $2 billion Great Lakes Fisheries, as well as our inland lakes fisheries may be at risk. Competition for food and spawning habitat could well place Michigan's sportfishery in jeopardy in the near future. Scientists have indicated that the zebra mussel may also act as an intermediate host for parasites that could infect fish and wildlife, and possibly even humans. It is well known that the introduction of any exotic species affects the integrity of the entire Great Lakes aquatic community. The magnitude of those effects is difficult to calculate precisely, but clearly zebra mussels will cause serious economic and ecosystem damage.

Michigan's Activities

Michigan Department of Natural Resources' Office of the Great Lakes has responded to the introduction of zebra mussels by establishing an aggressive public information program. The goal of the program is to provide information to arrest the rate of spread of zebra mussels to inland lakes and streams and to encourage environmentally sound management practices.

The Need for Federal Action

The solution to the nonindigenous species problem cannot be solved by any one state alone. As zebra mussels spread across the northern two-thirds of the United States, it will become a national problem.

H.R. 4214, introduced by Congressman Nowak, and its companion bill S. 2244, introduced by Senator John Glenn provide an effective framework to prevent introductions of future nuisance species. The major route by which nonindigenous species are introduced, the exchange of transoceanic ship ballast water, must be addressed. These bills would require the Coast Guard to regulate the unintentional introduction of nonindigenous species to U.S. waters by requiring high seas ballast water exchange, or ballast water treatment.

S. 2244 and H.R. 4214 would also require the Coast Guard to promulgate regulations to prevent the transfer of non-native aquatic species within the nation's territorial waters. It is imperative that this legislation move quickly to avoid further unwanted species introductions through ballast water exchange and ship transport.

The bills would establish a coordinated framework to address the broad, multi-faceted and national ramifications of nonindigenous species introductions. The approach to zebra mussel control has so far been piecemeal. The bills would help facilitate the development of coordinated management strategies by establishing a regional commission for the Great Lakes to coordinate research, control and educational programs and report to the National Cooperative Action Group.

The legislation also provides funding for research to advance the development of applied techniques to prevent and control aquatic nuisance species.

However, Michigan believes these provisions could be strengthened. First, the U.S. Army Corps of Engineers should be considered for inclusion on the regional commissions. Second, the list of zebra mussel control methods that the National Cooperative Action Group is required to maintain should also include evaluation of the control methods for environmental soundness and economic feasibility. Third, the Great Lakes Commission and the Great Lakes Fishery Commission should be utilized as the vehicles for coordinating zebra mussel efforts.

The funding provisions covering 1991 through 1995 for research, monitoring and education are critical so that we can begin to understand the biology of these species and discover ways to best manage them.

Water Resources Laboratory

University of Louisville
Louisville, Kentucky 40292
(502) 588-6731

UNIVERSITY of LOUISVILLE

June 12, 1990

Committee on Environment and Public Works
United States Senate
Washington, D.C.

Dear Senators:

Under your consideration is Senate Bill S.2244 authorizing monies to support research aimed at combating the invasion of the zebra mussel, *Dreissena polymorpha*, which recently entered North American waters. The original bill was meant to cover research in the Great Lakes region only, despite widespread acknowledgment in the scientific community that this hazardous mollusc will spread much farther south. I am writing in favor of a proposal to expand the geographic coverage of the research to the Water Resources "Ohio Region 5" and to augment the funds accordingly. Before providing information in support of the broader bill, I will briefly summarize the environmental hazards associated with this exotic species.

Zebra mussels have until very recently been confined to lakes and rivers of Europe where they have caused millions of dollars of damage by occluding the intake pipes of power plants, water companies, and all industries that draw water from sources containing this species. They also foul the hulls of commercial and recreational boats and are known to have sunk navigation buoys by their added weight. In North America, they are expected to pose an added, severe threat to the already endangered fauna of native unionid mussels, many of which are on federal and state endangered species lists and some of which are employed in the commercial pearl industry.

Two unique characteristics of *Dreissena* make this bivalve mollusc the most hazardous species ever to invade North American freshwaters. First, adults secrete proteinaceous threads that firmly join their shells to hard surfaces such as rocks, intake pipes, and boat hulls; adults of no other native or introduced species of mussel have this ability. These threads are so strong that the animal remains attached for long periods even after its death. Because they will bind themselves to each other, thick piles of mussels can develop containing thousands of individuals. Numbers as high as 700,000 individuals per square meter were recorded for one power plant intake canal in Lake Erie. Second, the larval stage of *Dreissena* swims freely in the water column, unlike native mussels which require a particular species of fish host for dispersal. This means that they can easily spread throughout a lake or downstream in a river. Movement against a current is more difficult but is aided by transport of adults on the hulls of barges and recreational boats.

As you may be aware, zebra mussels probably entered North America in 1987 or 1988 via the ballast water of a ship traveling from Europe. From their initial sighting in Lake St. Clair, they have rapidly expanded their range to include all of the Great Lakes, the St. Lawrence River, and inland lakes of Pennsylvania and New York. In addition to these confirmed sightings, rumors of this species's presence in the Mississippi basin are beginning to arise. As you will note below, these rumors, while perhaps unsubstantiated at this time, undoubtedly presage the eventual expansion of this mollusc throughout much of the United States.

At a recent symposium on zebra mussels held in conjunction with the annual meeting of the North American Benthological Society (scientists who study organisms on the bottoms of lakes and rivers), two ecologists working independently predicted that *Dreissena* would eventually spread south to northern Texas, east to the Atlantic Ocean, west to the Rocky Mountains, and north to the middle of Canada. Based on an analysis of European records, the distribution of zebra mussels in the United States is expected to be limited by warm temperatures and soft water. Evidence suggests that native predators (such as diving ducks and freshwater drum fish) will not be able to halt or appreciably slow the mussel's expansion.

Because zebra mussels first invaded a lake, some scientists and administrators have lost sight of the fact that this species also occurs widely in European rivers. Larvae can settle on hard surfaces and develop into adults as long as the current velocity does not exceed one meter per second at the time and place of settlement. Except during flood stage, the current velocities of our navigable rivers do not surpass this figure in all the habitats suitable for mussels. Therefore, there should be no impediment to the rapid movement of zebra mussels into rivers from the Great Lakes. We expect *Dreissena* to reach the Ohio River at Louisville, Kentucky within a year (assuming that this mollusc is not already here in initially low numbers).

Dispersal into the Mississippi and Ohio River basins is made especially easy by the presence of the Illinois canal, which links Lake Michigan to the Mississippi via the Illinois River, and by the proximity of the Allegheny River (a headwater tributary of the Ohio River) to Lake Erie. *Dreissena* will also be spread widely by recreational boaters who haul their boats along our vast interstate highways from one water body to another because adults can survive out of water for up to two weeks as long as temperatures are moderate and humidities are high.

To summarize, American and European experiences have shown that the zebra mussel is an extremely hazardous species. It is widely acknowledged that this mollusc will spread throughout the inland lakes and rivers in the midwestern, eastern, and southern portions of the United States where the cost of its control to utilities and industries using large amounts of water could be extremely high.

In the final part of this letter, I want to address the following three questions.

1. Why are any funds needed to study the zebra mussels in North America if they have been studied in Europe?

2. Why should Congress authorize funds for geographic regions and aquatic ecosystems outside the Great Lakes?

3. Why should an expanded coverage initially be limited to the Water Resources, Ohio Region 5?

The answers to the first question are that the European literature is not consistent, environmental laws are more strict here than in Europe, and our initial experience with zebra mussels in North American waters demonstrates that they act differently in this continent than in Europe. Most of the research conducted on *Dreissena* has been published in Soviet and Polish journals, with more recent work in Britain; there is a considerable amount of conflicting information in the scientific and industrial literature of Europe about the effects and control of zebra mussels. Furthermore, as recent events in eastern Europe have shown, environmental laws are often not as strict in Europe as in North America. Consequently, the health of their aquatic systems is poorer, and the techniques that have used to control this pest are not always applicable or possible in our country. Moreover, the experience of utility companies in Lake Erie has clearly shown that the population sizes of infestations are greater by at least an order of magnitude over the European situation and, hence, the severity of the problem will be much worse here.

Our general knowledge of the biological structure and ecological functioning of aquatic ecosystems is much greater for the Great Lakes and small streams than for large navigable rivers. Indeed, scientists probably know more about the tundra biome than our critically important large rivers because of phenomenal differences in research funding over the last 20 years. Scientists working in the Great Lakes have a wider access to research funds than those working in large rivers. For example, the valuable Sea Grant program supports studies along our marine coasts and in the Great Lakes but not in our large rivers, which have nearly equal access to the ocean. While funds for studying and combating zebra mussels have started to trickle in, thus far all the money and research effort is being directed to the Great Lakes region. These include monetary sources such as the Great Lakes Protection Fund.

Because zebra mussels are currently spreading south and into our inland rivers and reservoirs, we desperately need to prepare for this invasion by conducting research in regions outside the northern range of the species and in habitats other than huge lakes. Their expansion into these areas is of immediate concern - it is not a distant problem whose resolution can be delayed much into the future.

Zebra mussels are likely to cause the most significant problems in the Midwest where environmental conditions are suitable for their rapid dispersal and greatest population explosion. The Water Resources "Ohio Region 5" is an area where the impact of the zebra mussel will be especially severe. In addition, because of the proximity of rivers and reservoirs throughout this region to the Great Lakes (via avenues described previously), the problem is of more immediate concern in the Ohio River basin than in more southern regions. If funds were adequate, research could begin over the entire projected range of this invading pest. Given the likely monetary constraints, however, I recommend that the limited funds for research be restricted to the Great Lakes and Ohio Region 5.

Scientists working in industry, government agencies, and universities are pooling their efforts to fight the zebra mussel in an attempt to lessen the environmental impacts of both its presence and the measures necessary to control its detrimental effects. Your help in providing research funds is the first crucial step in this battle. I appreciate your concern and your consideration of our request to expand research to Ohio Region 5 and to augment the total funds accordingly. I strongly encourage you to make these funds available as soon as possible so that we will have a chance to address this problem while it is still possible to exert some control on the zebra mussels.

Respectfully Yours,

James H. Thorp

James H. Thorp
Director and
Professor of Biology

1633 Broadway
New York, New York 10019
212 468.6000

New York Power Authority

July 10, 1990

The Honorable Max Baucus
Chairman
Subcommittee on Environmental
Protection
Environment and Public
Works Committee
U.S. Senate
SD-458 Dirksen Senate
Office Building
Washington, D.C. 20510-6175

Dear Mr. Chairman:

Re: Subcommittee Hearing on S.2244, Zebra
Mussel Infestation, on June 19, 1990

I am herewith enclosing comments which I ask be included in the written record of the Subcommittee's June 19th hearing on S.2244, regarding the Zebra Mussel infestation.

We at the New York Power Authority consider the issue of the Zebra Mussel infestation one of the greatest challenges of the 90's for those users of water on the Great Lakes. We foresee a devastating impact on Great Lakes water users if the problem is not confronted immediately.

We welcome the Committee's efforts in finding a solution to this very serious problem and we are ready to take part in a coordinated effort to find a long-term solution.

If you have any questions or comments, please contact my office 212-468-6391.

Thank you.

Sincerely,

Vincent J. Tobin

Vincent J. Tobin

enc.

COMMENTS
OF THE NEW YORK POWER AUTHORITY
FOR INCLUSION IN THE RECORD OF THE
ENVIRONMENT AND PUBLIC WORKS COMMITTEE
ENVIRONMENTAL PROTECTION SUBCOMMITTEE
UNITED STATES SENATE
HEARING ON JUNE 19, 1990 ON
THE "NONINDIGENOUS AQUATIC NUISANCE ACT OF 1990"

The New York Power Authority is one of the nation's largest non-federal public power organization and provide about one-quarter of the electricity used in New York State. We are a nonprofit public corporation which finances, builds and operates electric generating and transmission facilities for the purposes specified in our legislative charter.

We own and operate two major hydroelectric power projects that are powered by the waters of the Great Lakes Basin--the St. Lawrence-Franklin Delano Roosevelt Power Project at Massena, New York, and the the Niagara Power Project, located on the Niagara River approximately 4 1/2 miles north of Niagara Falls.

Production costs at our Niagara and St. Lawrence facilities are among the cheapest in the United States, and this power is critical to the economic well being of the customers it serves, both residential and industrial. Power from these two facilities is sold to 47 municipal electric systems and four rural cooperatives in New York State, and to three upstate utilities for the benefit of their rural and residential customers.

Pursuant to federal law and State policy, the projects also serve specified industries that directly employ more than 42,000 workers and are the economic backbone of Western and Northern New York. Additionally, the power is sold for the benefit of millions of rural and domestic consumers in the neighboring states of Vermont, Massachusetts, Connecticut, Rhode Island, Pennsylvania, New Jersey and Ohio.

Each year, these projects provide savings to electricity consumers and other economic benefits that exceed their combined construction cost of about $1 billion. In addition to their enormous economic benefits, these projects have significant environmental and strategic value. The Niagara and St. Lawrence Projects are directly responsible for the energy equivalent of more than 35 million barrels of oil per year.

In addition to two hydro projects, the Power Authority owns and operates two nuclear power plants that are dependent on water from the Great Lakes and the Hudson River.

The James A. FitzPatrick nuclear power plant is located near Oswego on Lake Ontario. Power from the FitzPatrick Plant is sold to utilities throughout the State, and half

of its capacity is dedicated to fostering economic development. FitzPatrick power is provided to customers such as the Grumman Corporation on Long Island, Chase Manhattan Bank in New York City, General Motors in Westchester and other companies throughout the State.

Our other nuclear power plant, Indian Point 3, located near Buchanan on the Hudson River, serves the electric needs of the public entities in Westchester and New York City, including the Metropolitan Transportation Authority, the New York City Housing Authority, and city and county school districts.

Since virtually 100% of our generation comes from thermal and hydro facilities located on inland waterways, the Power Authority is very concerned about potential damage from an unchecked infestation of zebra mussels at these facilities.

By interfering with the maximum effective operation of our plants, zebra mussels could jeopardize the reliable economic supply of power to a wide variety of critical components of our society. Power production from these facilities could only be replaced by more expensive, less environmentally-compatible energy sources.

Since its introduction into Lake St. Clair via ballast water discharge in 1986, the zebra mussel (Dreissena polymorpha) has spread rapidly throughout the lower Great Lakes. Specimens were found recently as far downstream as Massena, New York, a distance of approximately 600 miles. The mollusk has recently been observed in Duluth Harbor, its first appearance in Lake Superior. Left unchecked, the zebra mussel has the potential to infest the waters of most of the continental United States.

The zebra mussel has been a serious biofouling pest in Europe, and now appears to have found its own niche in North American waters. The prolific Dreissena has the potential to foul municipal and industrial water intake facilities, disrupt the ecosystem, interfere with sport and commercial fisheries, navigation, recreational boating and beach use.

Dreissena's sudden appearance in North American waters, and its aggressive reproductive rate, requires water users to rapidly respond to the serious threat that it poses. We lack the luxury of time to adapt to its presence.

The utility industry has moved to cope with the Dreissena problem at several levels. At the national level, the Electric Power Research Institute (EPRI) has formed a Zebra Mussel Advisory Group to disseminate information, coordinate monitoring and control technologies and fund appropriate research projects.

In New York State, the Empire State Electric Energy Research Corporation (ESEERCO), that consists of the state's seven investor owned utilities and the Power Authority recently concluded an agreement with New York Sea Grant Extension for a Zebra Mussel Information Clearing House, essentially a technology transfer effort. Another project under way is a statewide zebra mussel monitoring project that will provide early warning of the mussels' dissemination throughout New York waters. A proposal for bacteriological control of the mussels and a project using sound as a control technology are also being considered.

Each user of Great Lakes water must face the eventuality of being impacted by Dreissena. The Power Authority has initiated monitoring programs for the mussel at our three Great Lakes facilities, and has designed and implemented various controls (see Attachment A). Monitoring will allow

us to determine the concentration of mussel larvae in the water column, the settling and infestation rates, and eventually the growth rate of mussels.

Technology available to date for the control of the Zebra mussel usually entails the discharge of chemicals (either chlorine or molluscicides) into the water supply system, and requires approval (in New York) from the Department of Environmental Conservation (DEC). This approval generally comes in the form of an amendment to the facility's State Pollution Discharge Elimination System (SPDES) permit. The effectiveness, and impacts of chlorination will be closely monitored by the Power Authority and the DEC.

The Niagara Project and FitzPatrick Plant systems differ slightly in the approach to chlorination, but the primary focus is on the service water lines that supply the cooling water requirement to systems critical to normal plant operations. Our estimated cost for implementing the chlorination technology at the Niagara Project and FitzPatrick Plant is $100,000 and $175,000, respectively.

The worst case impact from Dreissena on Power Authority operations would be the total interruption of electric generation to allow mechanical maintenance of effected systems. It is difficult to definitively quantify the potential financial worst case impact under such a scenario. However, replacement cost for this power, based on current avoided cost estimates within the New York Power Pool, would be approximately 7.5 times greater for power from the hydro facilities, and approximately 2 times greater for the power from the nuclear plant. This of course presumes that the other facilities are not impacted in the same fashion, and that replacement power is available.

The bill which was the subject of June 19th's hearing, S.2244, the Nonindigenous Aquatic Nuisance Act of 1990, establishes necessary research, control, and educational programs at the national level but focuses attention first on the Great Lakes Region of the United States.

The available control technology for zebra mussels relies on various chemical applications. These methods are being closely scrutinized by the regulatory agencies, and have

been approved primarily as an emergency, stop-gap measure. For long-term control of this and other exotics, more coordinated research is necessary. The research program outlined in Title II, in conjunction with other research efforts, like those by the utility industry, should benefit the public relying on the waters on North American for such a significant portion of their daily routine.

The provisions of Title I of the bill direct the development of Coast Guard regulations to prevent and control transport of foreign organisms into waters of the United States through ship ballast waters. Regulatory controls of this nature may have prevented the introduction of the zebra mussel into this country. The Power Authority supports efforts to implement such measures which may preclude the introduction of other exotics via this pathway.

We at the New York Power Authority feel that if unchecked, the continued infestation of the zebra mussel will present one of the most significant environmental challenges of the 1990's for the users of the waters of the Great Lakes. We applaud the efforts of Congress to find solutions to this problem, and are prepared to assist as part of a coordinated effort to find a solution in the most environmentally-compatible and inexpensive manner as possible.*

STATEMENT
OF
JAMES L. HENRY, PRESIDENT
OF THE
TRANSPORTATION INSTITUTE
BEFORE THE COMMITTEE ON
ENVIRONMENT AND PUBLIC WORKS
U.S. SENATE

JUNE 19, 1990

The Transportation Institute, a research and educational organization representing over 140 U.S.-flag vessel operating companies engaged in all aspects of marine transportation, wishes to comment on S. 2244, the Nonindigenous Aquatic Nuisance Act of 1990.

The need for legislation to control the rapidly expanding crisis of the invasion of the zebra mussel and to prevent the introduction of other harmful nonindigenous species is obvious. The U.S. Fish and Wildlife Service has estimated that the potential economic damage from the zebra mussel alone could reach $5 billion by the end of the decade. Additional nonindigenous species, both in the Great Lakes and other freshwater and coastal areas of the United States are also responsible for much damage to natural ecosystems, water supplies, commercial and recreational fishing activities, maritime industries and other recreational and industrial usage of our nation's waters. The Nonindigenous Aquatic Nuisance Act of 1990 addresses both the control and prevention of the introduction of exotic species. With certain changes and strengthening it will serve as a comprehensive and effective means of achieving these goals.

Prevention of the Unintentional Introduction of Nonindigenous Species

Title I of the Act deals with preventing the unintentional introduction of nonindigenous species into U.S. waters, mandating that the U.S. Coast Guard ("USCG") establish and enforce regulations to this effect. The legislation as written stresses the high seas exchange of ballast water as the foremost means for prevention of exotic species introduction. However, high seas ballast exchange is not a panacea. Although it is thought to be the primary cause of exotic species introduction, ballast exchange by itself is an inadequate means of preventing new invasions of exotic species. A number of supplementary alternatives need to be researched, developed and implemented to insure that harmful nonindigenous species will be excluded from U.S. waters. Additionally, there are a number of dangers and costs associated with ballast exchange that make the need for flexible regulations critical. As the USCG states, "performance-oriented,

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rather than engineering-specific, criteria" should be used. The Nonindigenous Aquatic Nuisance Act must reflect this desired emphasis on obtaining the correct end results rather than mandating the specific methods that the Coast Guard should require in its regulations.

High seas ballast exchange is an inadequate means of prevention for a variety of reasons. One hundred percent transfer of water when vessels exchange ballast water at sea is unlikely. Consequently, any coastal, briny or salt-water species that the exchange process does not eject from the tanks may survive and be introduced into U.S. waters. There have already been a number of harmful salt-water exotic species introductions that the ballast exchange method might not have prevented, such as the asiatic clam in San Francisco Bay and "red tide" dinoflagellates.

Waterborne sediments are often carried into ships' tanks with ballast water and accumulate there despite ballast exchange. These sediments can serve as a transporting medium for many exotic species, and high seas ballast exchange may not be a completely effective means of eliminating this means of introduction. Species such as the spiny water flea (Bythotrephes), another nonindigenous aquatic nuisance in the Great Lakes, may have been introduced through ballast sediment. Additionally, some organisms may be carried on other portions of vessels, including anchor chains, cooling systems, and on the hulls and rudders of vessels. Although the high seas ballast exchange program might be a significant factor in reducing introductions, alternatives and supplements must be developed and implemented.

An additional complication with reliance on ballast exchange is that it subjects vessels to certain operational hazards. Ballast helps maintain the stability of the vessel, allowing the ship to sit at the proper height in the water and to balance its load evenly. The emptying of ballast during the exchange process temporarily removes the safety benefits of the ballast. The exchange process simultaneously subjects the vessel to the "free surface effect," meaning that during those times that the tanks are only partially full there is an additional negative effect on stability from the sloshing of ballast water. These two dangerous destabilizing factors would be additionally aggravated by the heavy seas that one finds most often on the open ocean where this legislation mandates the exchange process occur.

In addition to adverse effects on vessel stability, high seas ballast exchange can cause greater hull bending, thereby increasing metal fatigue and reducing the strength and life span of the vessel. The additional emptying and filling of the ballast tanks with salt water during the exchange process will subject the interior of vessels to increased wear and corrosion. Finally, the vessel's crew may have a heavier workload and increased fatigue, a critical safety concern. Title I should strengthen Section

201(d)(1) and its provision for a vessel's master to ensure the safety of his ship, passengers and crew by legislating alternatives to the ballast exchange process.

Stronger pumps sending ballast water through smaller pipes might both increase safety by reducing the exchange process time and help prevention through higher water velocities. In the tanker sector, danger from vessel instability might be reduced by filling empty cargo holds while emptying ballast tanks in order to maintain proper trim. However, this would likely have adverse pollution effects from oil and chemical tankers where hazardous cargo residue would contaminate the ballast water to be released. This method would not be feasible with other vessel types.

Witnesses representing the Department of Interior, the Coast Guard, the Great Lakes Commission, and the Great Lakes Fisheries Commission have all testified as to the need for the development and inclusion of alternatives to ballast exchange as a means of prevention. The legislation currently recognizes exceptions to the requirement for high seas ballast exchange for vessels that solely traverse U.S. territorial waters or North American coastal waters and for vessels that already are regulated to treat their ballast waters. The USCG, in consultation with maritime industry, must further clarify and define these terms. Moreover, for the above reasons it is critical to develop alternative methods of prevention not only for these exceptions, but for all vessels.

Australia, which has already suffered several deleterious invasions of nonindigenous species, has instituted a flexible and effective program of prevention. Vessels must certify that either they will not discharge ballast in Australian waters, or that they will ballast at sea or provide in-hold ballast treatment, or that the ballast water is already free of toxic organisms. The U.S. legislation should provide these same alternatives to ships serving our nation's ports.

Other practical alternatives that should be examined include the treatment of ballast water with heat, ultrasound, ultraviolet light, or bleaching agents and disinfectants such as chlorine, sodium hypochlorite or potassium permanganate. It is critical to the effectiveness, safety and cost of the prevention program that alternatives to high seas ballast exchange be developed and that the flexibility of the legislation be maintained and strengthened.

The zebra mussel invasion and the threat of future nonindigenous aquatic nuisances are problems of international scope. Not only the Great Lakes, but other areas in the United States and Australia, the Netherlands, Chile, Norway and elsewhere are suffering from the introduction of exotic species, including American jellyfish in the Soviet Black Sea. Because of the global

nature of this problem, it is critical for the United States to cooperate and coordinate activities with other nations, particularly Canada.

Canada has a voluntary ballast exchange program in place that already has 85% compliance. The USCG and Great Lakes Fisheries Commission were in consultation with Canada in the development of this program, and Section 204 of the Nonindigenous Aquatic Nuisance Act should reflect more strongly the need for joint action. Dovetailing the U.S. program with existing Canadian guidelines will hopefully facilitate implementation and reduce the need for vessels transiting the St. Lawrence Seaway to comply with redundant rules. Supplementing the existing program with alternative prevention methods will make for more effective, comprehensive and efficient prevention of exotic species introduction.

The International Maritime Organization ("IMO") is forming a working group to develop standards for the prevention of introduction of exotic species. Given the fact that 96% of U.S. waterborne commerce is carried on foreign-flag vessels, it is important to develop global awareness and international guidelines to exclude nonindigenous species from wreaking havoc in new environments. The Nonindigenous Aquatic Nuisance Act should specifically recognize the importance of establishing a global system of prevention and the role of the IMO in carrying this out.

Nonindigenous Species Research, Control, and Education Programs

A strong, efficient, and standardized program for research, control, and education must be developed as a priority. Aquatic invaders such as the zebra mussel already have caused tremendous damage and threaten much more. Minimizing these potential damages, estimated at $5 billion this decade for the zebra mussel alone, requires prompt, effective action. Although crisis-response measures are being taken, a coordinated, regional plan needs to be quickly formulated and acted upon. Along with a comprehensive control program to alleviate current threats, a coordinated long-term research and education program must be developed in preparation for the potential dangers of future introductions of harmful nonindigenous species.

There may not be time in the rapidly escalating crisis that exists in the Great Lakes region to establish entirely new organizations or commissions with corresponding bureaucracies. Consideration should be given to having existing bodies address the control of nonindigenous species in the Great Lakes. The specific provisions for the Great Lakes region (Section 201(e)) should establish the Great Lakes Fisheries Commission and the Great Lakes Commission as the supporting agencies for the regional commission.

Such a designation would facilitate the immediate action that is called for in the Great Lakes by the zebra mussel invasion.

The legislation as written designates too narrow of a membership group for the regional commissions. It provides for a representative of the "raw water users industry," and although such representation is merited in the current case of the zebra mussel invasion, such might not always be the situation. For example, in response to the spiny water flea invasion, separate representatives of commercial and recreational fishing groups might be warranted. The legislation does not provide for any representation of our nation's ports or the shipping industry, both of which are dramatically affected by the proposed legislation. A reduction in the eight (out of fifteen) seats currently reserved for local governments would allow for greater flexibility in the regional commission member selection and would provide more equitable and representative commissions.

Additionally, the legislation should provide for non-voting members of regional commissions. It is likely that Canada would be interested in having an observer at the regional commissions for the Great Lakes, Pacific Northwest and New England, and one can easily imagine other situations in which observers may be warranted. As nonindigenous species will by nature frequently have leading experts from other nations, a provision to allow for outside consultation should also be specifically included in the section detailing the administrative provisions relating to regional commissions. For instance an expert from Europe, where the control of zebra mussels has been an issue for over 150 years, might be helpful to the Great Lakes regional commission.

The maritime industry is already suffering extensive damages from the zebra mussel. Congress must act soon to help alleviate this crisis. This legislation, while necessary, should not impose an even greater burden on shipping interests by increasing their responsibilities and costs and adding yet another layer of regulation to their operations. In order to follow its expressed intent to alleviate this crisis, the funds for the execution of this program must come from general revenue sources.

Finally, the funding clauses in the legislation must be increased and expanded. Eradication of the zebra mussel is now probably impossible, and control of an organism that will latch onto watercraft and can live out of water up to fourteen days will be highly problematic. The purpose and findings of the Nonindigenous Aquatic Nuisance Act call for strong, immediate action to control the zebra mussel, yet no money is allocated for control activity in the five-year appropriations authorization.

Outside of Coast Guard funds for the prevention of future infestations, all of the funding authorizations in S. 2244 are for research, education, monitoring, and extension and administrative

services. These authorizations are necessary and should not be reduced. However, research and control activities have previously been conducted that serve as sufficient guidance for immediate federal action. Appropriations, limited to $5 million a year, are authorized as 1:1 matching funds for the states' zebra mussel control efforts in this session's Water Resources Bill. But an integrated, comprehensive and coordinated basin-wide effort must be made if control activity is to be effective. Federal action, rather than piecemeal, localized activity, is necessary to control the zebra mussel. Immediate federal funding should be provided for control action before the infestation spreads too dramatically.

In summary, the Transportation Institute supports the goals and intent of the Nonindigenous Aquatic Nuisance Act of 1990. But consideration should be given to amending the legislation to more comprehensively and effectively manage this crisis and prevent others. Alternatives to the inadequate program of ballast exchange must be included in the legislation now. The need for immediate action mandates that existing organizations be utilized and new bureaucracies be avoided. Coordination with Canada is essential if the zebra mussel crisis is to be controlled. The regional commission should be made more representative with maritime industry participation and funding for active control measures should be included in the bill. With these amendments included, the zebra mussel may be controlled and future nonindigenous invaders may be excluded from U.S waters.

II

101ST CONGRESS
2D SESSION

S. 2244

To prevent and control infestations of the coastal and inland waters of the United States by the zebra mussel, and other nonindigenous aquatic nuisance species.

IN THE SENATE OF THE UNITED STATES

MARCH 7 (legislative day, JANUARY 23), 1990

Mr. GLENN (for himself, Mr. HEINZ, Mr. LEVIN, Mr. KOHL, Mr. SPECTER, Mr. MOYNIHAN, Mr. KASTEN, Mr. DIXON, Mr. D'AMATO, and Mr. METZENBAUM) introduced the following bill; which was read twice and referred to the Committee on Environment and Public Works

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A BILL

To prevent and control infestations of the coastal and inland waters of the United States by the zebra mussel, and other nonindigenous aquatic nuisance species.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. SHORT TITLE.

This Act may be cited as the "Nonindigenous Aquatic Nuisance Act of 1990".

SEC. 2. DEFINITIONS.

As used in this Act, the term—

(1) "ballast water" means any water taken aboard to be used for ballasting purposes (to manipulate the trim and stability of a vessel);

(2) "nonindigenous species" means any species that is not native to an ecosystem, including any such organism transferred from one country into another;

(3) "high seas" means waters outside of the exclusive economic zone of any nation;

(4) "environmentally sound" methods or techniques means methods or techniques that have a minimal impact on the natural ecology of an ecosystem, including integrated pest management techniques with an emphasis on nonchemical measures; and

(5) "aquatic nuisance" means a nonindigenous species which threatens the biodiversity, environmental stability, or the economic or recreational development of an infested water resource.

SEC. 3. FINDINGS.

The Congress finds that—

(1) the transport of untreated water between ports in the ballast tanks of ships results in unintentional introductions of nonindigenous species to fresh, brackish, and saltwater environments;

(2) when environmental conditions are favorable, nonindigenous species become established, successfully

reproduce, and may disrupt the ecology and industry of an area;

(3) several nonindigenous species which could be transported into the waters of the United States in ballast tanks are known to be actual or potential threats to saltwater or freshwater ecosystems;

(4) the zebra mussel (Dreissena polymorpha) was unintentionally introduced into the Great Lakes in Lake St. Clair through ballast water exchange, and the species became established and rapidly spread downstream throughout Lake Erie and into Lake Ontario;

(5) if left uncontrolled, through downstream transportation of larvae and unintentional transport via boats and water transfers among drainage basins, the zebra mussel is expected to infest over two-thirds of the continental United States;

(6) the zebra mussel colonizes water inlet pipes (which causes reduced water flow), boat hulls (which causes increased drag), and other hard surfaces;

(7) the potential disruption of aquatic ecosystems by the zebra mussel, including adverse effects on biodiversity of lakes and reductions in fish populations (including sport and commercial fisheries, and other fish populations), could be severe;

(8) a coordinated research, control, and education effort is needed to attenuate the spread of the zebra mussel and other aquatic nuisance species throughout the United States;

(9) specifically, research is needed to explore environmentally sound approaches to control such nuisance species; and

(10) research is also needed on the basic biology of aquatic nuisance species, particularly the zebra mussel, and the environmental impacts of such aquatic nuisance species, including impacts on biodiversity.

SEC. 4. PURPOSES.

The purposes of this Act are—

(1) to prevent unintentional introduction of nonindigenous species into waters of the United States through ballast water management and other requirements;

(2) to coordinate research, control activities, and information regarding aquatic nuisance species, and reduce the burden of these tasks from already overburdened State and local agencies;

(3) to contain the spread of the zebra mussel and other aquatic nuisance species in the waters of the United States through educational programs geared to early identification and control methods;

(4) to establish aquatic nuisance species research programs to develop environmentally sound control methods, monitor distribution, study the basic biology of such species, and investigate potential human health impacts of such species, as well as potential environmental and economic impacts;

(5) to minimize economic and ecological impacts of nonindigenous aquatic nuisance species if any such species become established (as has the zebra mussel); and

(6) to declare the zebra mussel an injurious species and to provide for further declarations of injurious species status as needed to prevent the intentional transport of aquatic nuisance species (other than for permitted research purposes).

TITLE I—UNITED STATES COAST GUARD REGULATIONS

SEC. 101. REGULATIONS TO PREVENT UNINTENTIONAL INTRODUCTION OF NONINDIGENOUS SPECIES INTO AND WITHIN THE WATERS OF THE UNITED STATES.

(a) IN GENERAL.—(1) The Secretary of the department under which the Coast Guard is operating (hereafter in this Act referred to as the "Secretary"), acting through the Com-

mandant of the United States Coast Guard, and in consultation with—

(A) the Secretary of Commerce, acting through the Administrator of the National Oceanic and Atmospheric Administration;

(B) the Secretary of the Interior, acting through the Director of the United States Fish and Wildlife Service;

(C) the Administrator of the Environmental Protection Agency; and

(D) the heads of other relevant departments or agencies (as determined by the Secretary);

shall, not later than 6 months after the date of the enactment of this Act, promulgate such regulations as may be necessary for the prevention and control of the transportation into the waters of the United States of viable biological materials in the ballast waters of ships.

(2) Except as provided in subsections (b) and (c), the regulations promulgated under this subsection shall—

(A) require a vessel to carry out a high sea exchange of ballast water prior to releasing ballast water into any of the waters of the United States; and

(B) allow for the use of alternative ballast water management methods in lieu of the method described in subsection (A) as such alternative methods are de-

veloped and recommended by the Secretary pursuant to paragraph (5) of subsection (d).

(b) REGULATIONS TO PREVENT UNINTENTIONAL TRANSFERS.—The Secretary, in consultation with the officials described in subparagraphs (A) through (D) of subsection (a)(1), shall promulgate such regulations as the Secretary determines to be necessary to prevent the unintentional transfer or introduction of nonindigenous species by ships operating exclusively within the territorial waters of the United States or contiguous coastal waters of North America (as defined by the Secretary). A ship described in this subsection shall not be subject to high seas ballast water exchange requirement described in subsection (a)(2).

(c) EXEMPTION FOR SHIPS THAT TREAT WATER.—A ship that is subject to requirements that prescribe the treatment of ballast water for the removal of chemical contaminants shall not be subject to the high seas ballast water exchange requirement described in subsection (a)(2).

(d) REQUIREMENTS FOR REGULATIONS.—The regulations promulgated under subsections (a) and (b) shall—

(1) ensure the right of any captain of a ship to protect the safety of his ship and the crew and passengers of such ship;

(2) apply to all foreign flag ships and United States flag ships; and

(3) for the purpose of reflecting the principle that the ballast water from one ship is sufficient for the introduction and establishment of an aquatic nuisance species, include an enforcement mechanism such as—

(A) mandatory return to deep sea ballast exchange areas;

(B) fines; and

(C) application of other environmentally sound ballast water treatment methods;

(4) provide for random sampling procedures to monitor compliance and for sampling for the biological content of ballast water (in cooperation with the appropriate officials of the United States Fish and Wildlife Service); and

(5) be revised as more methods are developed and recommended by the Secretary (in consultation with the officials described in subparagraphs (A) through (D) of subsection (a)(1)), on the basis of the findings of the report required under section 207 of the Coast Guard Authorization Act of 1989, or on the basis of other reports that the Secretary determines to be appropriate.

(e) CIVIL PENALTY.—The Secretary of Transportation is authorized to assess a civil penalty in an amount not to exceed $25,000 against the owner or operator, or both, of any ship in violation of regulations promulgated pursuant to

this Act. All civil penalties assessed pursuant to this Act shall be available, as provided by appropriation Acts, to endow research on the control of nonindigenous species.

TITLE II—ZEBRA MUSSEL AND AQUATIC NUISANCE SPECIES RESEARCH, CONTROL, AND EDUCATIONAL PROGRAM

SEC. 201. COORDINATION OF RESEARCH.

(a) NATIONAL COOPERATIVE ACTION GROUP.—(1) The Secretary of the Interior, acting through the Director of the United States Fish and Wildlife Service, and the Secretary of Commerce, acting through the Administrator of the National Oceanic and Atmospheric Administration (hereinafter referred to as the "National Cooperative Action Group"), shall jointly take such action as may be necessary to coordinate national research, control, and educational efforts associated with the infestation of the zebra mussel and other aquatic nuisance species in the waters of the United States.

(2)(A) The National Cooperative Action Group is authorized to establish such regional commissions as the National Cooperative Active Group determines to be necessary to assist in carrying out the purposes of this Act.

(B) A regional commission described in subparagraph (A) shall be—

(i) established along the boundaries of one or more adjacent, similarly infested (with aquatic nuisance species) water resource region, as defined in the United States Geological Survey 1982 map of surface water and related land resource development in the United States and Puerto Rico; and

(ii) composed of not more than 15 members appointed by the National Cooperative Action Group as follows:

(I) 1 regional representative of the Department of the Interior;

(II) 1 regional representative of the Department of Commerce;

(III) 1 regional representative from the Environmental Protection Agency;

(IV) 1 representative from the raw water users industry (as defined by the National Cooperative Action Group), or an association of such raw water users industry;

(V) 1 representative from the recreational and sport fishing industry (as defined by the National Cooperative Action Group);

(VI) not more than 8 representatives of State governments and the governments of political subdivisions of States; and

(VII) not more than 2 representatives of regional organizations or authorities selected by the National Cooperative Action Group.

(3) The National Cooperative Action Group shall coordinate the regional commissions established under this section and facilitate the transfer of information among such regional commissions.

(4) Upon the request of the chairman of any regional commission, and after consultation with the National Cooperative Action Group, the head of any Federal department or agency is authorized to detail to such regional commission any of the personnel of such department or agency to assist the regional commission in the performance of the functions of such regional commission under this Act.

(5) The Secretary of the Interior and the Secretary of Commerce may provide to each regional commission such administrative and technical support services as the Secretary of the Interior and the Secretary of Commerce determine to be necessary for the effective functioning of such regional commissions.

(6) The Administrator of General Services is authorized to furnish each regional commission under this Act with such offices, equipment, supplies, and services as the Administrator is authorized to furnish to any other agency or instrumentality of the United States.

(7) The National Cooperative Action Group shall provide timely advice to the Secretary of State concerning aquatic nuisance species that infest water resources shared with other countries.

(b) ROLE OF REGIONAL COMMISSIONS.—Regional commissions established pursuant to this section shall—

(1) identify regional priorities with respect to aquatic nuisance species;

(2) make recommendations to the National Cooperative Action Group concerning aquatic nuisance species;

(3) coordinate programs established to carry out the purposes of the Act; and

(4) issue, on at least an annual basis, a report on regional research and education concerning aquatic nuisance species to the National Cooperative Action Group on regional research and education.

(c) ADMINISTRATIVE PROVISIONS RELATING TO REGIONAL COMMISSIONS.—(1) Members of a regional commission established pursuant to this section shall serve at the pleasure of the National Cooperative Action Group.

(2) Members of a regional commission shall receive no additional pay, allowances, or benefits by reason of service to the regional commission. Members who are not full-time Federal employees may be allowed travel expenses and per diem,

in lieu of subsistence, at rates authorized for persons serving intermittently in the Government service under subchapter I of chapter 57 of title 5, United States Code, to the extent funds are available for such expenses.

(3) A majority of the members of a regional commission shall constitute a quorum, but one or more members designated by the regional commission may hold hearings.

(4) Members of a regional commission shall select a chairman from among the members of the regional commission.

(5) Each regional commission shall meet in the geographical area of the regional commission at the call of the chairman of the regional commission or upon the request of a majority of the members of the regional commission.

(6) Each regional commission may establish committees or work groups of technical representatives of members of the regional commission to advise the regional commission on specific matters relating to the functions of the commission authorized under this Act.

(7) Each regional commission may nominate, and assign duties to, a coordinator and such other full-time and part-time employees as the National Cooperative Action Group determines to be necessary for the performance of the functions of the regional commission.

(d) EFFECT OF FEDERAL ADVISORY COMMITTEE ACT.—Except as otherwise provided by this Act, each regional commission shall operate pursuant to the Federal Advisory Committee Act (5 U.S.C. App).

(e)(1) REGIONAL COMMISSION FOR THE GREAT LAKES.—Not later than 30 days after the date of the enactment of this Act, the National Cooperative Action Group shall establish a regional commission for the Great Lakes region described in paragraph (2).

(2) For the purposes of this subsection, the Great Lakes Region shall encompass the following regions (as designated in the United States Geological Survey 1982 map of surface water and related land resource development in the United States and Puerto Rico):

(A) Great Lakes Region 4;

(B) Ohio Region 5; and

(C) Upper Mississippi Region 7.

(3) The National Cooperative Action Group shall request that the Great Lakes Fishery Commission (established under the Great Lakes Fishery Act of 1956)—

(A) designate a representative to serve on the regional commission described in this subsection;

(B) advise, coordinate, and provide secretarial services on matters related to Great Lakes fisheries,

related environmental concerns, and interactions with the Government of Canada; and

(C) provide technical services for any technical committee established by the National Cooperative Action Group to address matters described in subparagraph (B).

(4) The National Cooperative Action Group shall request that the Great Lakes Commission (established under article IV of the Great Lakes Basin Compact to which the Congress granted consent in the Act entitled "Granting the consent of the Congress to a Great Lakes Basin Compact, and for other purposes", approved July 24, 1968)—

(A) designate a representative to serve on the regional commission described in this subsection;

(B) advise, coordinate, and provide secretarial services on matters related to the economic impacts of the zebra mussel on the geographic area of the Great Lakes region (including impacts on industry), and interactions with the Government of Canada; and

(C) provide technical services for any technical committee established by the National Cooperative Action Group to address matters related to the economic impacts of the zebra mussel on the geographic area of the Great Lakes region (including impacts on industry).

SEC. 202. LEAD AGENCIES.

(a) ROLE OF THE SECRETARY OF COMMERCE.—As part of the regional effort to address aquatic nuisance species infestations in the United States, the Secretary of Commerce, acting through the Administrator of the National Oceanic and Atmospheric Administration (who shall consult the head of the National Sea Grant College Program) shall, in response to the recommendations of the regional commissions established under section 201, serve as the head of the lead agency in connection with programs to—

(1) carry out administrative activities related to the regional commissions;

(2) investigate the basic biology of aquatic nuisance species;

(3) research, propose, and evaluate aquatic nuisance species control methods (with an emphasis on environmentally sound methods of control for industrial, commercial, and recreational users of infested waters);

(4) provide timely advice to the Administrator of the Environmental Protection Agency, the Director of the United States Fish and Wildlife Service, and the chairmen of the regional commissions established under section 201, concerning aquatic nuisance species control methods proposed or in use;

(5) develop and implement educational programs through Sea Grant Marine Advisory Services, and any other available resources that the Secretary of Commerce determines to be appropriate to inform the general public, State governments, governments of political subdivisions of States, and industrial and recreational users of aquatic resources in connection with matters concerning the identification of aquatic nuisance species, and control methods for such species, including the prevention of the further distribution of such species;

(6) notify State governments and the governments of political subdivisions of States, private raw water users (as defined by the Secretary of Commerce), and other interested or affected entities that the Secretary of Commerce determines to be appropriate, of projected rates and directions of spread of the zebra mussel and other aquatic nuisance species in a manner that will facilitate timely planning to avoid, prevent, or compensate for likely impacts of such aquatic nuisance species;

(7) investigate methods for minimizing the economic impacts of the zebra mussel and other aquatic nuisance species on public, commercial, and private waters;

(8) assist in efforts in the public and private sector to control economic impacts of the zebra mussel and other aquatic nuisance species; and

(9) maintain a current list of control methods in use within the region served by such regional commission and and make the list available upon request.

(b) ROLE OF SECRETARY OF THE INTERIOR.—As part of the regional effort to address aquatic nuisance species infestations in the United States, the Secretary of the Interior, acting through the Director of the United States Fish and Wildlife Service, shall. in response to the recommendations of the regional commissions established under section 201, serve as the head of the lead agency in connection with programs to—

(1) investigate the basic biology of the zebra mussel and other nonindigenous species;

(2) research, and evaluate aquatic nuisance species control methods to protect biodiversity and the fisheries of infested waters (with emphasis on environmentally sound methods) and make recommendations concerning such methods;

(3) establish a program with the assistance of the United States Coast Guard for the random sampling of ballast tanks;

(4) monitor the distribution and spread of the zebra mussel and other aquatic nuisance species, generate projections on the rate and direction of spread of such infestations, and, with the assistance of personnel of Sea Grant Marine Advisory Services, notify regions where infestations are pending for the purposes of advanced planning;

(5) monitor the effects on human health of the zebra mussel and other aquatic nuisance species;

(6) research and monitor effects of the zebra mussel and other aquatic nuisance species on biodiversity of the infested regions; and

(7) advise the Administrator of the Environmental Protection Agency, the Administrator of National Oceanic and Atmospheric Administration, and the chairmen of the regional commissions concerning current aquatic nuisance species control methods proposed or in use.

(c) MEMORANDA OF AGREEMENT CONCERNING LEAD AGENCY STATUS.—To maximize use of existing facilities, lead agency status within the boundaries of a given regional commission designation may be altered or shared by a mutual agreement between the departments or agencies described in subsections (a) and (b) through a memorandum of agreement filed not later than 60 days after the formation of the regional

commission that is the subject of the memorandum of agreement. Such memorandum of agreement shall specify the activities for which the signatories to the agreement shall be responsible, and shall contain such provisions as are necessary to ensure the coordinated implementation of such activity. In the absence of a memorandum of agreement, lead agency status shall be determined pursuant to subsections (a) and (b).

(d) In regions for which inland waters (except for the Great Lakes) comprise the majority of the affected waterways (as in water resource regions 10, 11, 13, 14, 15, and 16 of the United States Geological Survey 1982 map of surface water and related land resource development in the United States and Puerto Rico) the United States Fish and Wildlife Service shall cooperate with Federal departments and agencies that implement other related programs in effect on the date of the enactment of this Act to fulfill all lead agency roles (as described in subsections (a) and (b)).

SEC. 203. RESEARCH RESTRICTIONS.

(a) LOCATION OF RESEARCH ACTIVITIES.—The research activities authorized under this Act concerning an aquatic nuisance species shall be carried out only within drainage basins infested with such aquatic nuisance species.

(b) ALLOCATION OF FUNDING.—To the extent possible, funds for research authorized under this Act shall be allocat-

ed to existing facilities within the areas infested by the aquatic nuisance species subject to study.

(c) RESEARCH PRIORITIES.—In funding research related to the basic biology of aquatic nuisance species, priority shall be given to research to advance the development of applied techniques of aquatic nuisance species prevention and control, and the funding of such research efforts should be carried out as soon as is possible.

SEC. 204. INTERACTIONS WITH FOREIGN COUNTRIES.

(a) The Secretary of State, in consultation with the National Cooperative Action Group and the Secretary, shall, to the extent allowable by law, initiate negotiations with the governments of foreign countries concerning the planning and implementation of prevention, research, education, and control programs related to aquatic nuisance species infesting shared water resources.

(b) In the case of the Great Lakes, the activities of the National Cooperative Action Group, the National Oceanic and Atmospheric Administration, the United States Fish and Wildlife Service, and the regional commission for the Great Lakes established under section 201(e) of this Act, shall conform with the goals of the Boundary Waters Treaty of 1909 and the Great Lakes Water Quality Agreement as amended in 1987 and such agencies shall cooperate with the Great

Lakes Fishery Commission in all matters affecting Great Lakes fisheries.

SEC. 205. REPORTS.

Not later than 180 days after the date of the enactment of this Act, and annually thereafter, the Cooperative Action Group shall submit a report to the appropriate committees of the Congress that—

(1) summarizes reports of the regional commissions established under this Act and includes a summary of the progress of the regional commissions in meeting the goals established for such commissions under this Act; and

(2) makes recommendations concerning prevention and control of aquatic nuisance species that the Cooperative Action Group determines to be appropriate.

SEC. 206. INJURIOUS SPECIES.

In accordance with section 42 of title 18, United States Code, the Secretary of the Interior shall declare the zebra mussel (Dreissena polymorpha) an injurious species.

SEC. 207. SEA GRANT SERVICES AND GRANTS TO UNIVERSITIES.

(a) GRANTS FOR UNIVERSITY RESEARCH.—The appropriate lead agency, as determined under this Act, shall allocate funds authorized under this Act for competitive uni-

versity research grants to be administered through the Sea Grant College program to study aquatic nuisance species.

(b) EDUCATION AND ASSISTANCE SERVICES.—In addition to the education and assistance services described under this Act provided by Sea Grant Marine Advisory Services, the appropriate Sea Grant College Program is authorized conduct education and assistance services related to the prevention and control of aquatic nuisance species.

SEC. 208. AUTHORIZATION OF APPROPRIATIONS.

There are authorized to be appropriated for fiscal years 1991, 1992, 1993, 1994, and 1995, in addition to any other amounts that may be authorized—

(1) $850,000 to fund research at the Great Lakes Environmental Research Laboratory and other laboratories of the National Oceanic and Atmospheric Administration (of which not more than $100,000 shall be used to fund administrative services by the Great Lakes Commission);

(3) $1,650,000 to fund Sea Grant competitive university research grants described in section 207 which are conducted in the Great Lakes Region (as defined in paragraph (2) of section 201(e) of this Act);

(4) $500,000 to fund Sea Grant College Program education and extension services described in section 207 which are conducted in the Great Lakes Region;

(5) $100,000 to fund administrative services of the Great Lakes Fishery Commission;

(6) $1,000,000 to fund research authorized under this Act conducted through the United States Fish and Wildlife Service in the Great Lakes Region;

(7) $3,300,000 to fund regulatory activities of the United States Coast Guard authorized under this Act;

(8) $500,000 to fund Sea Grant Marine Advisory Service national education and extension services;

(9) $500,000 to fund nationwide monitoring activities by the United States Fish and Wildlife Service; and

(10) such other sums as may be necessary to carry out the purposes of this Act.

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